



**CARBON<sup>®</sup> DIGITAL LIGHT SYNTHESIS<sup>™</sup>**

# CARBON<sup>®</sup> DIGITAL LIGHT SYNTHESIS<sup>™</sup> (DLS)

## General process information

<b>DESCRIPTION</b>	Carbon's Digital Light Synthesis (DLS) is a resin-based polymer additive manufacturing process. Light is projected in a series of layered patterns as the build platform rises, selectively solidifying the UV-curable resin to achieve a green state part. After build, some of the resins will also require a secondary thermal cure to complete the process. The DLS process produces isotropic material properties.	
<b>BENEFITS OF DLS</b>	<ul style="list-style-type: none"><li>• Production-grade parts off the printer</li><li>• Isotropic material properties</li><li>• Smooth surface finish and fine details</li><li>• High throughput</li></ul>	
<b>BUILD VOLUME</b>	<b>M2 Printer</b> <ul style="list-style-type: none"><li>• ~189 x 118 x 326 mm</li><li>• ~7.4 x 4.6 x 12.8 in</li></ul>	<b>L1 Printer</b> <ul style="list-style-type: none"><li>• ~400 x 250 x 460 mm</li><li>• ~15.7 x 9.8 x 18.1 in</li></ul>
<b>MIN. FEATURE SIZE</b>	<b>Material dependent, typically:</b> <ul style="list-style-type: none"><li>• ~0.25 - 0.5 mm</li><li>• ~0.01 - 0.02 in</li></ul>	
<b>BEST ACHIEVABLE TOLERANCE</b>	<b>Material dependent, typically at least:</b> <ul style="list-style-type: none"><li>• +/- 0.3 mm</li><li>• +/- 0.012 in</li></ul>	Validated builds can hold tighter tolerances, but require review from engineering team. Costs will be adjusted to reflect inspection and quality fallout.
<b>LEAD TIME</b>	<ul style="list-style-type: none"><li>• Typically 4 business days, can expedite orders to as low as 2 business days.</li></ul>	

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## Materials (continued on pages 17 and 18)

RIGID MATERIALS		
MATERIAL	COLOR	DESCRIPTION
Rigid Polyurethane - RPU 70	Black	<ul style="list-style-type: none"><li>• Best for aesthetic prints</li><li>• Great combination of strength, stiffness, and toughness</li><li>• Versatile in printing capabilities</li><li>• Better built for high volume production</li></ul>
Rigid Polyurethane - RPU 130	Black	<ul style="list-style-type: none"><li>• Best for aesthetic prints and good for high durability dampening applications</li><li>• Great combination of strength, stiffness, toughness, and ductility</li><li>• Versatile in printing capabilities</li><li>• Requires a heated cassette for printing, making cleaning and support removal difficult compared to RPU 70</li></ul>
Epoxy - EPX 82	Black	<ul style="list-style-type: none"><li>• Temperature resistant, strong, and tough</li><li>• Comparable to lightly glass-filled thermoplastics</li><li>• Perfect for connectors, brackets, and housings</li><li>• Better built for high volume production</li></ul>
EPX 86	Black	<ul style="list-style-type: none"><li>• Flame retardant variant of EPX 82</li><li>• Prints as easily as EPX 82, with similar design rules</li><li>• Good chemical resistance and functional toughness</li><li>• Higher stiffness and more brittle than EPX 82</li></ul>

## Finishing / post-processing options

- Painting
- Press-fit inserts
- Bead blasting
- Digital Texturing

# CARBON<sup>®</sup> DIGITAL LIGHT SYNTHESIS<sup>™</sup> (DLS)

## Materials (continued)

RIGID MATERIALS		
MATERIAL	COLOR	DESCRIPTION
Urethane Methacrylate - UMA 90	Select RGB colors	<ul style="list-style-type: none"><li>• Perfect for manufacturing jigs, fixtures, and general-purpose prototypes</li><li>• Comparable to conventional SLA resins</li><li>• Ideal for quick and aesthetic prints</li></ul>
IND 405	Clear	<ul style="list-style-type: none"><li>• Clear, semi-rigid, and very flexible</li><li>• For when translucence is an aesthetic requirement but perfect optical clarity is not</li></ul>
Medical Polyurethane - MPU 100	White	<ul style="list-style-type: none"><li>• Biocompatible, sterilizable, and durable</li><li>• Perfect for medical products and devices, consumer health care products, and drug contact</li></ul>
Cyanate Ester - CE 221	Orange	<ul style="list-style-type: none"><li>• Highly temperature resistant and stiff</li><li>• Comparable to glass-filled nylon</li><li>• Perfect for applications that need long-term thermal stability such as under-the-hood components, electronics assemblies, etc.</li></ul>

## Finishing / post-processing options

- Painting
- Press-fit inserts
- Bead blasting
- Digital Texturing

# CARBON<sup>®</sup> DIGITAL LIGHT SYNTHESIS<sup>™</sup> (DLS)

## Materials (continued)

NON-RIGID MATERIALS		
MATERIAL	COLOR	DESCRIPTION
IND 147 - HDT 230	Black	<ul style="list-style-type: none"> <li>• Highly temperature resistant and stiff</li> <li>• Ideal for tooling and molding applications.</li> <li>• Perfect for applications that need long-term thermal stability such as under-the-hood components, electronics assemblies, etc.</li> </ul>
Elastomeric Polyurethane - EPU 40	Black	<ul style="list-style-type: none"> <li>• Rubbery, elastic material</li> <li>• Highly impact and tear resistant</li> <li>• Better built for dampening than EPU 41</li> <li>• Better fine feature resolution than EPU 41</li> </ul>
Elastomeric Polyurethane - EPU 41	Linen green	<ul style="list-style-type: none"> <li>• Rubbery, elastic material</li> <li>• Highly impact and tear resistant</li> <li>• Better built for energy return than EPU 40</li> <li>• Better for larger volumes than EPU 40</li> <li>• Easier to print than EPU 40</li> </ul>
Silicone - SIL 30	Light gray	<ul style="list-style-type: none"> <li>• Soft touch, biocompatible, and tear resistant</li> <li>• Sterilizable, good for skin contact medical applications</li> <li>• Perfect for comfortable skin contact products such as headphones, wristbands, and attachment wearables</li> </ul>

## Finishing / post-processing options

- Painting
- Press-fit inserts
- Bead blasting
- Digital Texturing





# STRATASYS FUSED DEPOSITION MODELING (FDM)

# STRATASYS FUSED DEPOSITION MODELING (FDM)

## General process information

<b>DESCRIPTION</b>	The most common additive method on the market. This process uses a spool of plastic filament which is melted down and deposited layer-by-layer until a 3-dimensional part is created.
<b>BENEFITS OF FDM</b>	<ul style="list-style-type: none"><li>• Engineering-grade materials</li><li>• Industry certifications</li><li>• Large build volume</li></ul>
<b>MAX. PART SIZE</b>	<ul style="list-style-type: none"><li>• 914 x 610 x 914 mm</li><li>• 36.0 x 24.0 x 36.0 in</li></ul>
<b>MIN. FEATURE SIZE</b>	<ul style="list-style-type: none"><li>• 0.4 mm</li><li>• 0.016 in</li></ul>
<b>BEST ACHIEVABLE TOLERANCE</b>	<ul style="list-style-type: none"><li>• 0.381 mm</li><li>• 0.015 in</li></ul>
<b>LEAD TIME</b>	<ul style="list-style-type: none"><li>• As low as 3 business days</li></ul>

# STRATASYS FUSED DEPOSITION MODELING (FDM)

Materials (continued on page 27)

MATERIAL	COLOR	LAYER HEIGHT OPTIONS
Ultem 1010	Tan	0.010", 0.013"
Ultem 9085	Black, Tan	0.010", 0.013"
Ultem 9085 CG	Tan	0.010", 0.013"
PC-10	White	0.005", 0.007", 0.010", 0.013"
PC-ABS	Black	0.005", 0.007", 0.010", 0.013"
ASA	Black, Dark Gray, White, Ivory, Light Gray, Red, Orange, Yellow, Green, Dark Blue	0.005", 0.007", 0.010", 0.013", 0.020"
ABS-ESD7	Black	0.007", 0.010"

## Finishing / post-processing options

- Painting
- Heat staked inserts
- Bead blasting
- Helicoil inserts
- Sanding



# STRATASYS FUSED DEPOSITION MODELING (FDM)

## Materials (continued)

<b>MATERIAL</b>	<b>COLOR</b>	<b>LAYER HEIGHT OPTIONS</b>
ABS-M30i	Ivory	0.005", 0.007", 0.010", 0.013"
ABS-M30	Black, White, Gray, Ivory, Red, Blue	0.005", 0.007", 0.010", 0.013"
PPSF	Tan	0.010"
ST-130	Natural	0.013"
Nylon 6	Black	0.010", 0.013"
Nylon 12	Black	0.007", 0.010", 0.013"
Nylon 12CF	Black	0.010"
Antero 800NA	Tan	0.010"
Antero840CN03	Black	0.010"

## Finishing / post-processing options

- Painting
- Heat staked inserts
- Bead blasting
- Helicoil inserts
- Sanding

# HP MULTI JET FUSION (MJF)



# HP MULTI JET FUSION (MJF)

## General process information

<b>DESCRIPTION</b>	<p>HP MJF is a powder bed fusion process. Our MJF projects are produced on 4200 and 5200 printers which selectively apply fusing and detailing agent, and thermal energy, to layers of powder in order to form solid parts. The printers then re-apply a new layer of powder to the top of the build and repeat the process until the print is complete. After excavation from the powder bed, finished parts undergo bead-blasting to achieve optimal surface finishes.</p>			
<b>BENEFITS OF HP MJF</b>	<ul style="list-style-type: none"> <li>• Produces fine features and complex parts</li> <li>• More consistent isotropic mechanical properties in the Z build direction when compared to other additive processes</li> <li>• Does not require supports (self-supporting) allowing more design freedom</li> <li>• High throughput</li> </ul>			
<b>BUILD VOLUME</b>	<ul style="list-style-type: none"> <li>• 375 x 375 x 280 mm</li> <li>• 14.8 x 14.8 x 11.0 in</li> </ul>			
<b>MIN. FEATURE SIZE</b>	<ul style="list-style-type: none"> <li>• 0.5 mm</li> <li>• 0.02 in</li> </ul>			
<b>BEST ACHIEVABLE TOLERANCE</b>	<b>Features in X-Y Dimension (0-100mm feature size)</b> <ul style="list-style-type: none"> <li>• +/- 0.3 mm</li> <li>• +/- 0.012 in</li> </ul>	<b>Features in X-Y Dimension (&gt;100mm feature size)</b> <ul style="list-style-type: none"> <li>• +/- 0.3% of feature size</li> </ul>	<b>Features in Z Dimension (0-100mm feature size)</b> <ul style="list-style-type: none"> <li>• +/- 0.4 mm</li> <li>• +/- 0.016 in</li> </ul>	<b>Features in Z Dimension (&gt;100mm feature size)</b> <ul style="list-style-type: none"> <li>• +/- 0.4% of feature size</li> </ul>
<b>LEAD TIME</b>	<ul style="list-style-type: none"> <li>• As low as 4 business days for Nylon PA 12</li> <li>• As low as 5 business days for 40% Glass Bead Filled Nylon PA 12</li> <li>• As low as 5 business days for TPA</li> </ul>			

# HP MULTI JET FUSION (MJF)

## Materials

MATERIAL	COLOR	DESCRIPTION
Nylon PA 12	Gray or Black	<ul style="list-style-type: none"> <li>• Fine detail and high dimensional accuracy</li> <li>• Produces strong quality parts</li> <li>• Provides excellent chemical resistance to oils, greases, aliphatic hydrocarbons, and alkalies</li> <li>• Creates complex parts and lattice structures</li> <li>• Ideal for complex assemblies, housings, enclosures, and connectors</li> <li>• Biocompatibility – Meets USP Class I-IV and US FDA guidance for intact Skin Surface Devices</li> <li>• Certifications – UL 94, UL 746A</li> </ul>
Glass Bead Filled Nylon PA 12	Gray or Black	<ul style="list-style-type: none"> <li>• Produces stiff, functional parts</li> <li>• Provides dimensional stability along with repeatability</li> <li>• Ideal for applications requiring high stiffness like enclosures, housings, fixtures, and tooling</li> <li>• Certifications – UL 94, UL 746A</li> </ul>
TPA (Thermoplastic Polyamide)	Gray or Black	<ul style="list-style-type: none"> <li>• Springy with some resistance</li> <li>• Parts that need to bend, but not as soft as silicone or TPE</li> </ul>

## Finishing / post-processing options

- Painting
- Black dyeing
- Bead blasting
- Heat staked inserts
- Press-fit inserts
- Digital texturing
- Clear coat
- Vapor smoothing
- Laser surface decorating / etching

# HP MULTI JET FUSION (MJF) - COLOR

## General process information

<b>DESCRIPTION</b>	<p>The HP Jet Fusion 580 Color Printer is a first-generation, full color, polymer 3D printer. The 580 uses the same basic Multi Jet Fusion technology as the 4200/5200 printer models, but with the added capability of printing in color. It receives Cyan, Magenta, Yellow, and Black colored agents (CMYK).</p>				
<b>BENEFITS OF HP MJF COLOR</b>	<ul style="list-style-type: none"><li>• Produces full-spectrum color parts with a voxel-control system</li><li>• Produces accurate, functional parts with intricate detail</li></ul>				
<b>MAX. PART SIZE</b>	<ul style="list-style-type: none"><li>• 332 x 190 x 248 mm</li><li>• 13.1 x 7.5 x 9.8 in</li></ul>				
<b>MIN. FEATURE SIZE</b>	<ul style="list-style-type: none"><li>• 0.5 mm</li><li>• 0.02 in</li></ul>				
<b>BEST ACHIEVABLE TOLERANCE</b>	<table><thead><tr><th>Features in X-Y dimension</th><th>Features in Z dimension</th></tr></thead><tbody><tr><td><ul style="list-style-type: none"><li>• +/- 0.4 mm</li><li>• +/- 0.016 in</li></ul></td><td><ul style="list-style-type: none"><li>• +/- 0.8 mm</li><li>• +/- 0.031 in</li></ul></td></tr></tbody></table>	Features in X-Y dimension	Features in Z dimension	<ul style="list-style-type: none"><li>• +/- 0.4 mm</li><li>• +/- 0.016 in</li></ul>	<ul style="list-style-type: none"><li>• +/- 0.8 mm</li><li>• +/- 0.031 in</li></ul>
Features in X-Y dimension	Features in Z dimension				
<ul style="list-style-type: none"><li>• +/- 0.4 mm</li><li>• +/- 0.016 in</li></ul>	<ul style="list-style-type: none"><li>• +/- 0.8 mm</li><li>• +/- 0.031 in</li></ul>				
<b>LEAD TIME</b>	<ul style="list-style-type: none"><li>• As low as 5 business days</li></ul>				

# HP MULTI JET FUSION (MJF) - COLOR

## Materials

MATERIAL	COLOR	DESCRIPTION
CB Nylon PA 12	All CMYK values are accepted, but system is not capable of a perfect color match. Part geometry, orientation, and nesting position all affect the color uniformity and repeatability	<ul style="list-style-type: none"><li>• Produces strong, functional complex parts</li><li>• Provides excellent chemical resistance to oils, greases, aliphatic hydrocarbons, and alkalies</li><li>• Ideal for color and white parts like jigs, fixtures, labeling, presentation models and functional prototypes</li></ul>

## Color demonstration samples



## Finishing / post-processing options

- Painting
- Bead blasting
- Heat staked inserts
- Press-fit inserts
- Digital texturing
- Clear coat
- Vapor smoothing
- Laser surface decorating / etching



# STEREOLITHOGRAPHY (SLA)



GAP GAUGE 2MM (1) (2) PRINTING  
3 H 35 min  
Layer 3 / 240

PRINTING

# STEREOLITHOGRAPHY (SLA)

## General process information

<b>DESCRIPTION</b>	SLA is a type of photopolymerization 3D printing process capable of producing parts with excellent surface finishes and small feature resolution. During printing, a single laser traces the cross-section of a part layer by layer in UV-curable resin until the part is fully formed. SLA is more suited to prototypes and low-run parts due to its longer print times. Our factory houses Formlabs Form 3B and Form 3L printers.
<b>BENEFITS OF SLA</b>	<ul style="list-style-type: none"><li>• Intricate, accurate detailing</li><li>• Excellent surface finish</li><li>• Great for prototypes or one-off parts</li></ul>
<b>BUILD VOLUME</b>	<ul style="list-style-type: none"><li>• 335 × 200 × 300 mm</li><li>• 13.2 × 7.9 × 11.8 in</li></ul>
<b>MIN. FEATURE SIZE</b>	The minimum feature size is different for each resin, but we are able to achieve complex and aggressive geometry.
<b>LEAD TIME</b>	Get your prototypes in as little as three days. Production or high volume runs will be examined on a case by case basis.

# STEREOLITHOGRAPHY (SLA)

Materials (continued on pages 31 and 32)

MATERIAL	COLOR	DESCRIPTION
Biomed Clear	Clear	<ul style="list-style-type: none"><li>• Biocompatible,</li><li>• Sterilizable and solvent safe</li><li>• Good material properties</li></ul>
Clear	Clear	<ul style="list-style-type: none"><li>• Able to make clear parts with intricate features.</li><li>• Not optically clear but perfect to let light pass through and achieve some transparency</li></ul>
Rigid 4000	White	<ul style="list-style-type: none"><li>• Strong, stiff, and resistant to bending</li><li>• Soft matte white finish</li></ul>
Tough 2000	Gray	<ul style="list-style-type: none"><li>• Strong and sturdy</li><li>• Good for prototypes</li><li>• Resistant to bending</li></ul>

# STEREOLITHOGRAPHY (SLA)

## Materials (continued)

MATERIAL	COLOR	DESCRIPTION
Flexible 80A Clear	Black	<ul style="list-style-type: none"><li>• Dampening properties</li><li>• Good for cushioning and soft touch areas</li><li>• Stronger mechanical properties than Elastic</li></ul>
High Temp	Translucent Orange	<ul style="list-style-type: none"><li>• Detailed precise prototypes</li><li>• Able to withstand temperatures up to 238 °C</li></ul>
Durable	Translucent, Clear	<ul style="list-style-type: none"><li>• Pliable, impact resistant, lubricious</li><li>• Ideal for high wear areas or rigid parts that need to be pliable</li></ul>

## Finishing / post-processing options

- Painting
- Sanding
- Digital texturing
- Bead blasting
- Press-fit inserts

Other Formlabs materials available upon request.





**DIRECT METAL LASER SINTERING (DMLS)**  
**SELECTIVE LASER MELTING (SLM)**



# DIRECT METAL LASER SINTERING (DMLS) / SELECTIVE LASER MELTING (SLM)

## General process information

<b>DESCRIPTION</b>	DMLS/SLM is a high powered laser with powder based printing technology for consistent, reproducible quality part production. Produce parts with complex geometries including living hinges for a variety of industries or functions. Your part will be feasible and functional for all downstream applications or continued manufacturing applications.
<b>BENEFITS OF DMLS/SLM</b>	<ul style="list-style-type: none"><li>• Fast and reliable</li><li>• Design freedom</li><li>• DfAM support</li></ul>
<b>MAX FEATURE SIZE</b>	<ul style="list-style-type: none"><li>• 15 x 13 x 18 inches (381 x 330 x 457 mm)</li></ul>
<b>MIN. FEATURE SIZE</b>	0.004 inches (0.1 mm)
<b>LAYER THICKNESS</b>	0.003 – 0.006 inches (0.08 – 0.15 mm)
<b>LEAD TIME</b>	Get your prototypes in as little as three days. Production or high volume runs will be examined on a case by case basis.
<b>MATERIALS</b>	Multi-Material capabilities, Aluminum Alloy, Nickel Alloy, Maraging Steel, Stainless Steel, PA, Glass-Filled Nylon