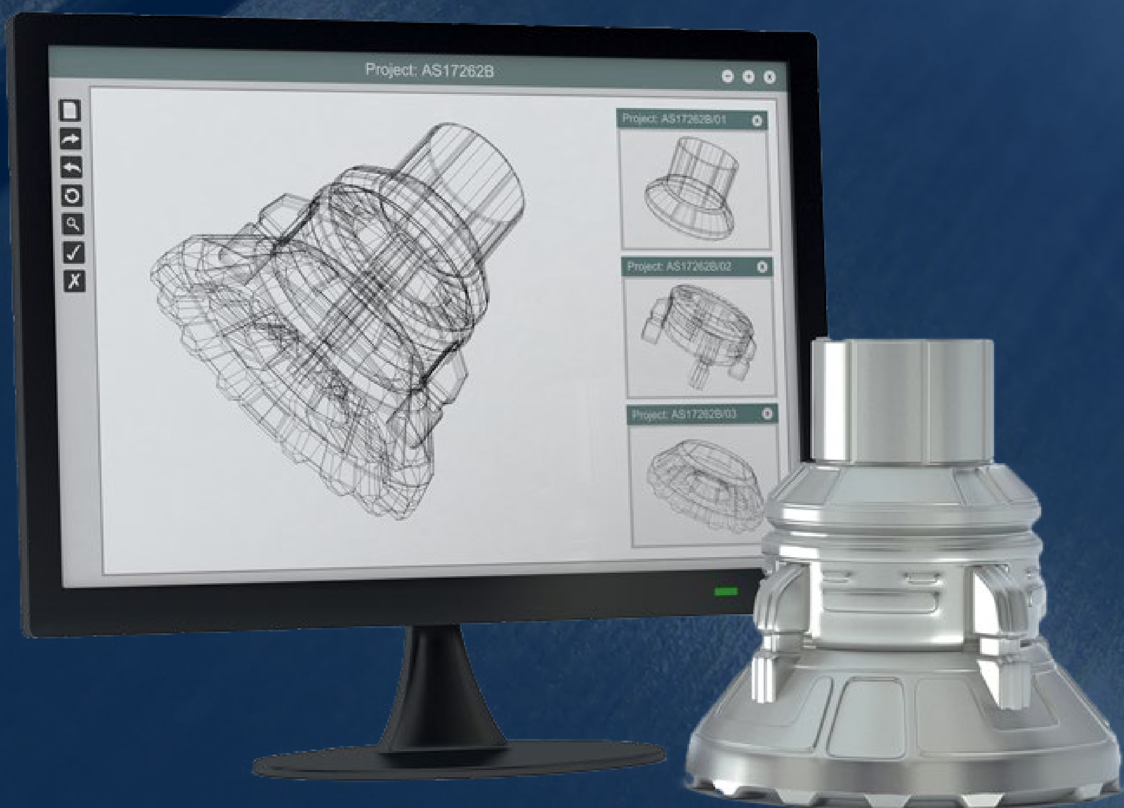
DECATUR MOLD
TOOL & ENGINEERING, INC.
Great Expectations Greater Results!

Rapid **Prototyping 101**

Master Basic Prototyping Concepts



Decatur Mold Offers:

Production Volume | Pricing

CLASS 105 MOLD: Prototypes

Cycles: Not exceeding 500
Description: Prototype only. This mold is constructed in the least expensive manner possible to produce a very limited quantity of prototype parts.

- Constructed from cast metal, epoxy, or any other material offering sufficient strength to produce minimum prototype pieces.

CLASS 104 MOLD: Low Volume Production

Cycles: Under 100,000
Description: Low production mold. This mold is used only for limited production, preferably with non-abrasive materials, and falls within a low to moderate price range.

- Mold design recommended.
- Mold base can be of mild steel or aluminum.
- Cavities can be of aluminum, mild steel, or any other agreed upon metal.

CLASS 103 MOLD: Medium Volume Production

Cycles: Under 500,000
Description: Medium production mold. This is a very popular mold for low to medium production needs and is available at a common price range.

- Detailed mold design recommended.
- Mold base must be minimum hardness of 8 R/C.
- Cavity and cores must be 28 R/C or higher.

CLASS 102 MOLD: High Volume Production

Cycles: Not exceeding one million
Description: Medium to high production mold. This mold, which is well-suited for abrasive materials and/or parts requiring close tolerances, is a high quality, fairly high priced option.

- Detailed mold design required.
- Mold base to be minimum hardness of 28 R/C.
- Molding surfaces should be hardened to a 48 R/C range. All other functional details should be made and heat treated.
- Temperature control provisions should be directly included in the cavities, cores, and slide cores wherever possible.
- Parting line locks are recommended for all molds.
- The following items may or may not be required depending on the ultimate production quantities anticipated. It is recommended that those items desired be made a firm requirement for quoting purposes:

  a. Guided Ejection **b.** Slide Wear Plates **c.** Corrosive Resistant Temperature Control Channels
  d. Plated Cavities

CLASS 101 MOLD: High Volume Production

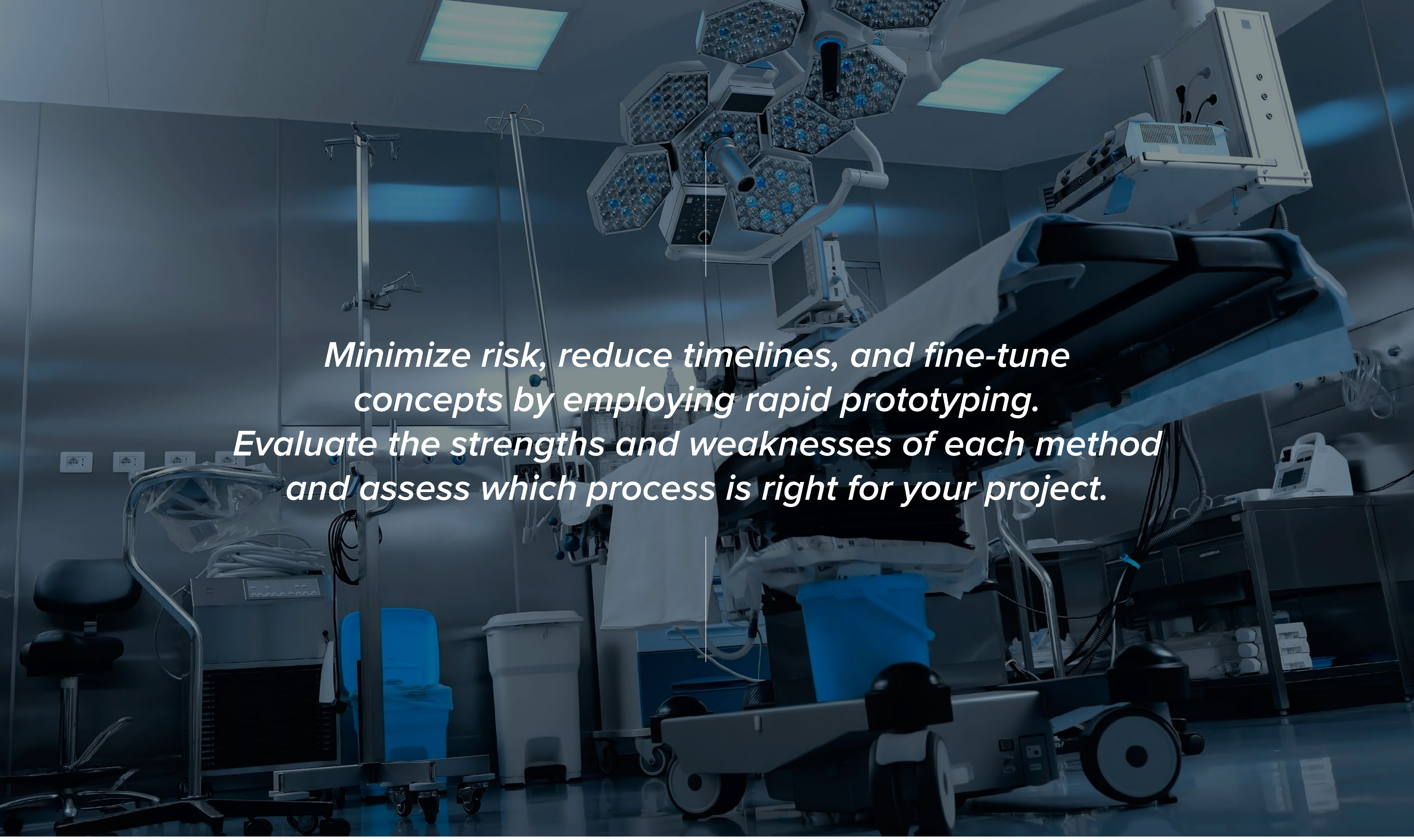
Cycles: One million or more
Description: Built for extremely high production. This is the highest priced mold and is made with only the highest quality materials.

- Detailed mold design required.
- Mold base to be minimum hardness of 28 R/C.
- Molding surfaces (cavities and cores) must be hardened to a minimum of 48 R/C range. All other details, such as sub-inserts, slides, heel blocks, gibs, wedge blocks, or lifters, should also be of hardened tool steels.
- Ejection should be guided.
- Slides must have wear plates.
- Temperature control provisions should be included in cavities, cores, and slide cores wherever possible.
- Over the life of a mold, corrosion in the cooling channels decreases cooling efficiency, thus degrading part quality and increasing cycle time. It is recommended that plates or inserts containing cooling channels be made of a corrosive resistant material or treated to prevent corrosion.
- Parting line locks are required on all molds.

Molding Part Runs with Decatur Mold

To handle almost any prototyping process, our facility is fully equipped with a range of injection molding machines, including:

- 72 Ton Nissei
- 300 Ton Nissei
- 88 Ton Nissei
- 503 Ton Nissei
- 154 Ton Nissei
- 946 Ton Nissei
- 239 Ton Nissei



Rapid Parts Prototyping Methods

Stereolithography (SLA)

Stereolithography (SLA) is one of the more versatile rapid prototyping technologies and goes by many names, including SLA rapid prototyping, optical fabrication, photo-solidification, solid-free-form fabrication, or solid imaging.

No matter the terminology, the process involves turning a three-dimensional Computer Aided Design (CAD) drawing into a solid object through the rapid, repeated solidification of liquid resin.

To create an SLA rapid prototype, a 3D CAD file is digitally “sliced” into horizontal cross-sections between 0.002” and 0.006” thick. These “slices” are entered into an advanced stereolithography rapid prototyping machine, where an ultraviolet laser traces the first layer of the part on a metal plate submerged just below the surface of a vat of photo-sensitive polymer. Wherever the laser touches the liquid, it solidifies. Once the layer is traced, the plate sinks the thickness of a layer below the level of the liquid. The next layer is then built upon the previous layer; In this manner, the entire part is built from the bottom up.

Selective Laser Sintering (SLS)

The use of selective laser sintering prototyping (commonly called SLS prototyping or 3D SLS prototyping) is ideal for product prototypes that require exceptional strength or must closely approximate the properties of thermoplastics.

In (SLS), three-dimensional parts are created by fusing ("sintering") powdered thermoplastic materials such as nylon, metals, and elastomers with the heat from an infrared laser beam. Thin powder layers are repeatedly laser sintered, creating the desired 3D piece based on a 3D CAD model.

SLA vs. SLS

Stereolithography (SLA) is often compared to selective laser sintering (SLS); however, there are several key differences between prototypes created with these two rapid manufacturing techniques.

These differences include:

- **Turn-around time:** SLA/SLS prototypes are based on a subcontractor's scheduled workload.
- **Tight tolerances:** SLA prototypes can achieve tolerances +/- 0.005" (0.127mm) for the initial inch, plus an additional 0.002" for each additional inch.
- **Surface finish:** SLA prototypes typically have a cosmetically superior finish, while SLS prototypes are typically powdery and granular.
- **Batch volume:** SLA is well suited for small-batch or small-lot manufacturing of prototype or end-use parts.
- **Prototype strength:** SLS prototypes are generally stronger and more durable than SLA prototypes.
- **Material properties:** SLS allows product prototypes to be created with material properties similar to those of injection molded prototypes.
- **Machining properties:** It is easier to machine prototypes created using SLS than those created using SLA.
- **Material choice:** SLS allows for product prototypes in many different thermoplastic or metal materials.
- **Metal product prototypes:** SLS can be used to create metal prototype parts using metallic powder in the laser sintering process.
- **Post-completion processing:** There is typically very little (if any) processing required after the SLS process is completed.

PolyJet 3D Printing

PolyJet industrial 3D printing is the most versatile of additive manufacturing service and provides a fast, cost-effective way to achieve visually striking rapid prototypes for pre-production and short-run production parts. The 3D printing equipment is the latest in PolyJet innovation and allows for rapid product prototype creation in complex shapes and forms.

PolyJet 3D printing is well-suited for parts with multiple material requirements, such as overlays or inserts with differing levels of flexibility, and can create prototypes that incorporate a full palette of colors. PolyJet 3D printing also employs a wide range of materials that can be used to create any number of durometers from hard to quite soft. In PolyJet 3D printing, a photo polymer is sprayed from a printhead cured with a UV lamp to quickly make small quantities of parts.

The 3D printing rapid prototyping process offers fine layer thickness in the Z dimension — this allows for small features along sidewalls and upfacing surfaces.

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Fused Deposition Modeling (FDM)

Fused deposition modeling (FDM), a common additive manufacturing and rapid prototyping technique, requires two kinds of materials to create a finished product. The first, a modeling material, uses the second, a support material, as a structure on which to develop the final piece or prototype.

In FDM, an extrusion nozzle lays melted plastic or metal material onto a base, also known as a build platform, in a cross section pattern based on coordinates supplied by the 3D CAD file. As each layer dries, the base is lowered for the next layer. Once the part comes off of the machine, support materials are removed by hand before the prototype is polished to final spec.

The fused deposition modeling process is excellent for:

1. High-stress testing; FDM prototypes can endure heat, chemical, and mechanical pressure.
2. Form and fit testing using highly detailed parts.
3. Small and detailed end-use parts.
4. Parts made of engineering-grade plastics (like ABS and polycarbonate).

Maximum Part Size	355 x 254 x 254 mm (14 x 10 x 10 in.)
Minimum Layer Thickness	0.013 inch (0.330 mm)
Achievable Accuracy	Parts are produced within an accuracy of +/- 0.005 inch or +/0.0015 inch per inch, whichever is greater (+/- 0.127 mm or +/- 0.0015 mm per mm)

Note: Accuracy is geometry dependent. Achievable accuracy specification derived from statistical data at 95% dimensional yield.

Direct Metal Laser Sintering (DMLS)

Direct metal laser sintering (DMLS) is an ideal rapid prototyping solution for clients that need 3D metal parts or prototypes quickly. Although DMLS typically costs more than other rapid prototyping techniques, it does not require special tooling; this allows for turnaround times of two to four weeks. Typically used for highly complex, intricate parts, DMLS offers a solution for parts that would be difficult or impossible to produce with traditional methods.

In DMLS, 3D metal parts are created by fusing ("sintering") powdered metals with heat from an infrared laser beam. Similar to SLS, these metal layers are repeatedly laser sintered, creating the desired three-dimensional piece based on a 3D CAD model or .stl file. Unlike SLS, there are multiple metal materials available for DMLS including aluminum, cobalt chrome, maraging steel, nickel alloy 625, nickel alloy 718, stainless steel, and titanium.

Materials: 15-5 Stainless Steel • Maraging Steel • Cobalt Chrome • Titanium Ti64 • Nickel Alloy N625

Maximum Part Size	250 x 250 x 325 mm (9.85 x 9.85 x 12.8in)
Variable Focus Diameter	100 - 500 µm (0.004 - 0.02 in)
Minimum Layer Thickness	20 µm (0.0008 in) or 40 µm (0.0016 in)
Resolution	20 - 50 µm (0.0008 in - 0.002 in)
Minimum Wall Thickness	0.3 - 0.4 mm (0.012 in - 0.014 in)
Tolerances	0.002 - 0.005 in.

Whether our team creates your parts in-house or subcontracts with another reputable manufacturer to develop your unique prototypes, you can rely on Decatur Mold to produce the exact parts and prototypes you need for your business. Contact us today to learn more about how our team can support your next project.

About Decatur Mold

In 1966, Decatur Mold was a five man shop with a 2,400 square foot facility, an excellent work ethic, and a desire to provide the best service and quality the industry had to offer. That commitment has proven successful and now Decatur Mold has grown to a world class facility with 100+ employees and more than 87,000 sq ft.

Decatur Mold continues to incorporate state of the art equipment and technology throughout our production process from design to finished mold. Our facilities operate 24/7. Technology and concepts have changed since 1966, but our commitment to our customers, our quality, and our employees has not.

Learn More *Contact us*

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