6 STEPS TO UNLOCK THE POWER OF POLYMER ADDITIVE MANUFACTURING

PARAGON Rapid Technologies

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THE WHY...

Additive manufacturing means improved accuracy, speedy turnaround times, greater flexibility and, in many cases, unrivalled cost efficiencies at every stage in the product development cycle.

Design Stage:

- Tooling costs erradicated
- Part consolidation and enablement of complex geometries
- Multiple iterations on the same platform
- Fast production time (hours) means designers can test ideas and concepts immediately

Materials Selection:

- Flexible and rigid production materials with a range of properties from high tensile strength to high heat resistance

Production:

- Real world parts in days as opposed to weeks
- Mass customisation
- Push the sustainability angle. There's little to no material wastage; and some materials are plant-based

DESIGN FOR AM

Designing for additive manufacturing or 3D printing is slightly different from designing for injection moulding or CNC machining. We advise you download our "Designing for [process]" guides from our website or LinkedIn:

- Evaluate what process is best for your part: HP MJF, Carbon DLS or SLS and don't forget to do an analysis of material properties. Our expert project engineers are on hand to make recommendations based on your application
- Be aware of your build volume
- Once you have determined process, review the features of your part. Each process will have recommended feature sizes that will ensure its printability. These include overhangs, unsupported angles, and unsupported wall thicknesses. For processes such as DLS and SLA, this will determine your support strategy
- Finally, optimise your design for supporting and printing. This includes:
  - Adjusting your CAD to high resoution
  - Supporting slice islands
  - Add fillets or chambers to sharp corners
  - Ensureing wall thickness is uniform; if changes are needed, make them as gradual as possible
  - Change the orientation of long, thin designs to ensure stability
  - Ask our technical design experts - they're trained to ensure all aspects of your design are optimised for quick and perfect parts

NOTE THE SPEED AND ACCURACY

Very little will beat additive manufacturing or 3D printing for speed. Depending upon size, complexity and process, your prototypes can be created in a matter of hours or days as opposed to weeks. Providing you are printing a whole part, and dependent upon size, they can be produced on demand, in batches almost as quickly. Obviously, those requiring support structures my take a little longer to finish as removal of pips will be a manual process.

Carbon DLS and HP MJF are some of the most accurate printers available, with unrivalled repeatability. Of course, this is also dependent upon your choice of materials and your part geometry. It also relies on you and your print technician optimising print layouts, and nesting parts appropriately.

- Carbon DLS general accuracy guideline is ±65 µm + 1 µm per mm dimension size
- Carbon DLS general production repeatability guideline is up to ±35 µm
- HP MJF general accuracy guideline is ±0.2 mm up to 100 mm and 0.2 % above that value
- Our SLS printers, in comparison, have a general accuracy of 0.3% with a minimum wall thickness of 1mm

SELECT THE RIGHT MATERIALS

Different polymer 3D printing technologies support various materials, including plastics, rubbers and composites. It goes without saying, you need to consider factors such as mechanical properties, durability, chemical resistance, and cost when choosing the materials for your specific needs

Paragon runs HP PA11 and HP PA12 nylon on its HP MJF printers. Both therse materials are known for their high strength, excellent impact resistance, and good chemical resistance. They offer a good surface finish and detail resolution when printed, making them suitable for applications that require aesthetic appeal. HP PA11 Nylon and HP PA12 Nylon can be used in various industries and applications, including automotive, consumer goods, industrial manufacturing, and more. They are versatile materials capable of fulfilling the requirements of different functional and structural components.

Paragon runs up to 12 materials on its four Carbon DLS printers, which are comparable to thermoplastics used in traditional manufacturing processes. These include rigid and elastomeric polyurethanes, silicones and very high temperature resistance cyanate esters. All Carbon materials are biocompatible, and some have been designed for specific functions, for example MPU 100 is a chemical resistant, medical grade polyurethane. They are designed to deliver predictable isotropic mechanical properties and an excellent surface finish. Some have a flame retardance rating; many of the elastomeres have a high tear resistance and all demonstrate an incredible robustness.

DEVELOP YOUR PARTS ...IN SITU

As a designer or design engineer, you have one goal: to give your company a competitive edge in its marketplace. This means that during the product design process, you'll be striving for quality, accuracy and speed. Your products need to be perfect for their end use, be they in consumer goods or aerospace.

The unrivalled design freedoms of additive manufacturing enables part evolution. Without the need for tooling, additive manufacturing is the release valve for the design process.

For some, this means multiple variations of a single design on the same build. Refining the designs until they work may take 5 builds, but this means 5 new sets of prototypes without incurring tooling costs.

For others, especially those in the medical sector where the development cycle can be much longer, additive manufacturing provides the opportunity for multiple revisions and refinements after field trial testing. For one client, multiple versions of their device, in a variety of complexities and materials were trialled in the field. The resultant device was one that was far more complex in design, but far more user-friendly and ergonomic, than the one designers set out to deliver 18 months earlier. These parts are now in production at volume, straight off the Carbon DLS machines, without a tooling cost in site.

EMBRACE THE COST SAVINGS

Additive manufacturing cost savings are multiple:

- **Set up costs are much lower** than some of the more traditional manufacturing processes. There's no initial investment for tooling. For HP MJF, post processing is carried out by machines.
- **Lead times are much shorter** - printing can take just a few hours and, depending upon quantities and required finishing, parts can be ready in a day; reducing development costs and ensuring time to market is considerably reduced
- **Elimination of the assembly process** - traditional manufacturing often involves multiple parts that need to be manufactured separately and then assembled. Additive manufacturing allows for part consolidation - the production of fully functional components in a single build, reducing the need for assembly processes. This consolidation of parts reduces labour costs and simplifies the overall production process
- Additive manufacturing is particularly advantageous for **low volume production or on-demand manufacturing**. Production can be scaled according to demand, avoiding the need for large minimum order quantities and reducing inventory costs

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