



Renishaw | Ultra 3D Printer

EnvisionTEC produces superior and precise 3D printers for a wide range of applications.

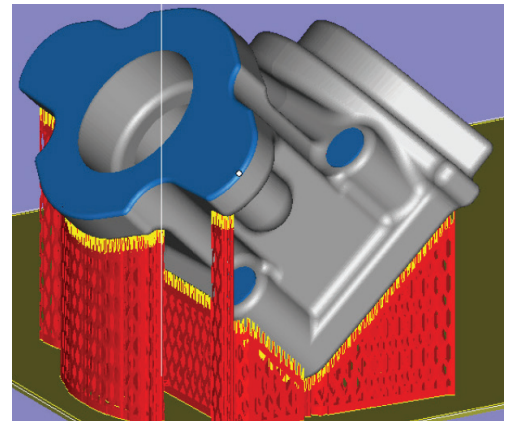
One of the applications that has seen the greatest success is the direct investment casting of large metal parts from resin patterns printed on EnvisionTEC Ultra 3D printers

3D printing is a technology sector that has progressed significantly during the three decades since it first emerged as a method for producing accurate concept models and form, fit and function prototypes. Today, most 3D printing headlines are focused on the technology as a means in and of itself, for the production of highly engineered, complex industrial parts at one end of the spectrum or simple, mass-customized plastic parts at the other end of the spectrum.

The profile of 3D printing that these headlines formulate however, while valid, overlook one of the most valuable applications of the technology - direct investment casting.

EnvisionTEC is an original equipment manufacturer (OEM) that produces superior and precise 3D printers for many different industry sectors and

a wide range of applications. One of the applications that has seen the greatest success is the direct investment casting of large metal parts from resin patterns printed on EnvisionTEC Ultra 3D printers.



To bear out this application and demonstrate its full potential, EnvisionTEC collaborated with Renishaw UK, a manufacturer of investment casting equipment capable of casting large parts up to 7 kg in Aluminium, to conduct specific trials. This paper provides an overview of the process.

The starting point was to design the parts (standard test pieces) which would be used as patterns, in 3D CAD.

Because the parts were going to be produced using an accurate additive layer manufacturing method, all of the necessary feeds and sprues could be included in the digital design at this early stage, rather than added by hand later.

Handling this type of complexity is one of the true added-value benefits of 3D printing for direct casting applications and it reduces the time involved in preparing the pattern greatly. From the 3D digital model it was then simply a case of exporting the data to create an .stl file for printing.

The parts were printed on an EnvisionTEC Ultra system using the proprietary and highly accurate EC 500 material at a resolution of 50 microns.



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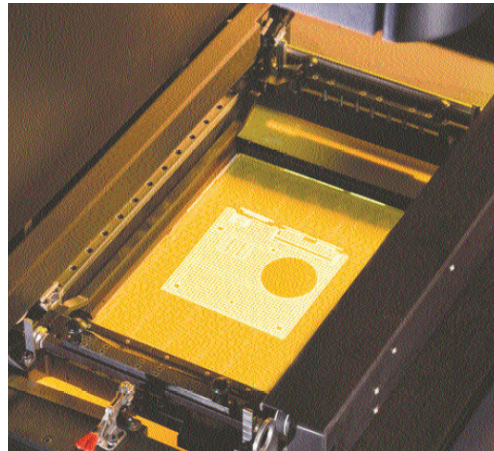
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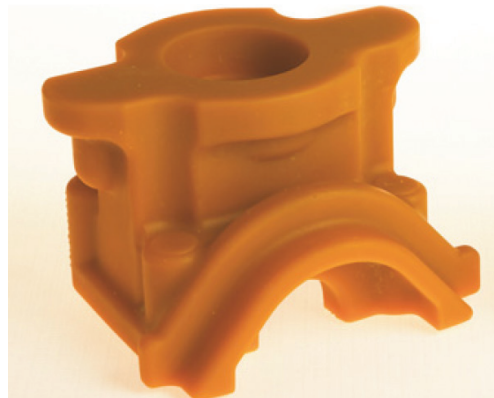
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The build time was five hours for up to eight parts and once off the EnvisionTEC Ultra 3D printing system, the parts underwent finishing procedures whereby they were cleaned and post-cured making them ready for direct casting.



The casting process employed utilised a Renishaw MPA300 metal part casting system and is outlined below:

The 3D printed parts were prepared on a wax investment casting tree and placed in a flask that was subsequently filled with typically M456 investment powder/slurry under vacuum using the MPA300 kit with a 28/100 water powder ratio.

The flask was then left to dry for approximately two hours, turned upside down and placed in furnace to burn out the tree and the parts from the mold.

This was achieved by heating to casting temperatures using a ramp up cycle as follows:

- Ramp to 200°C at 150°C per hour and hold for 4 hours
- Raise to 700°C at 200°C per hour and hold for 4 hours. (Reduce or increase temperature to casting temperature if required).



The flask is then blown out with compressed air and vacuumed, the metal is poured and the mould allowed to cool.

Once at an appropriate temperature the gypsum mould is broken down using a high powered water jet when the parts can be cut and finished from the tree. If required, the parts can be subsequently machined.



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