



## CASE STUDY

# Extra-Light Aircraft Door Hinge Cast in Magnesium

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3D printed sandcastings made with ExOne technology helped the France-based Ventana Group deliver a demonstration door hinge that was 40% lighter than the aluminum doors it regularly provides a global aerospace company



*“We started using the binder **jetting process for sand printing in 2000**. At first, we used it mainly for prototyping, but then we saw that it was possible to shorten our development time, so we started using it **for development and series production.**”*

Christophe Richard, CTIO of Ventana Group



## Challenge

Aircraft manufacturers are always scanning their designs to look for meaningful weight and performance improvements, leading Ventana to demonstrate the value that 3D printing could deliver in sandcasting a magnesium aircraft door hinge.

## Solution

Ventana Group Chief Technology Innovation Officer Christophe Richard has been using ExOne 3D printing technology to produce sandcastings since 2000. Today, the company has an S-Max® and the S-Max® Pro sand 3D printer that churns out sand cores for a hybrid sandcasting package that also includes traditional molds. The foundry based in Toulouse and Arudy, France, churns out aerospace and many other metal part designs with the technology, and Ventana believes that manufacturers need to know there are far more opportunities to be extracted from the innovative 3D printing technology when it comes to metalcasting. In early 2021, the Ventana board decided to showcase the full potential of sand 3D printing by casting a unique magnesium alloy part that showcased how design optimization and a novel material could deliver extreme benefits.



Christophe Richard speaking at ExOne booth at Formnext 2021



Aircraft door hinge metal casted in magnesium

### CUSTOMER

Ventana Group

### INDUSTRY / PRODUCTS

Foundry industry

### HEADQUARTERS

Narcastet, France

### EMPLOYEES

1,100

### CUSTOMER SPECTRUM

Industries such as aviation, space, defence, energy and motor sports

### WEBSITE

[www.ventana-group.eu](http://www.ventana-group.eu)

Magnesium is strong and lightweight, considered the lightest structural metal currently available. It is 75% lighter than steel, 50% lighter than titanium, and 33% lighter than aluminum. Magnesium also has the highest known damping capacity of any structural metal, capable of withstanding 10x more than aluminum, and with comparable mechanical properties – also making it potentially more beneficial in aerospace and other applications.

After optimizing the design with topological calculation and pouring simulation to extrapolate the best benefits of a binder jet 3D printed sandcasting, while also remaining true to the functional and strength requirements for the door, the Ventana team came up with a new “organic” design.

After 3D printing the core and pairing it with a traditionally manufactured mold, they used low-pressure metalcasting techniques to cast a cubic meter mold (600 x 450 x 300 mm) for the magnesium part. The precision of binder jetting enabled a successful pour on the first attempt. The demonstration part was partially machined and coated to showcase how the magnesium alloy would be coated with free Chrome VI new coating to prevent corrosion.

While the standard aluminum door hinge that Ventana produces for a global aerospace company weighs about 10 kilograms (22 pounds), Richard said the new magnesium door is about 5.9 kilogram (-13 pounds) - a meaningful savings for such a large part.

Featured at Formnext 2021, many observers of the part could not believe how light it was given its size.

Dr. Richard explained that tests are now being done on in-cabin use of magnesium in aircraft, to make even lighter and more efficient aircraft and other products. Those test cycles can be long, but he also noted that the optimized designs that can be produced with the S-Max printer family are capable of being printed today and poured in more traditional materials, such as aluminum.

Like ExOne, Ventana’s Dr. Richard believes manufacturers can be extrapolating much more value from this technology than they currently do with better Design for Additive Manufacturing (DfAM) strategies.

**VIDEO – See Christophe Richard speaking at Formnext 2021:**

[www.youtube.com/watch?v=rYy4MAeOV-0](https://www.youtube.com/watch?v=rYy4MAeOV-0)



S-Max sand 3D printer  
at Ventana facility

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*“Thanks to the binder jetting process we can **reduce the time to develop the parts and produce more and more complex parts.** We also use the technology for new developments with specific sand that we need to improve the quality of our parts.”*

Christophe Richard, CTIO of Ventana Group





## ExOne's Sand 3D Printing Machines

The S-Max® and S-Max® Pro are important tools enabling foundries to digitally manufacture sand cores and molds for metalcasting. With these trusted machines, you can go from design to metalcasting in hours or days instead of weeks and months. No more patterns needed for sand molds. No more molds needed for blowing cores. No jigs or fixtures needed for core assembly. Print complex cores in one piece. This is how cores were meant to be made.

- Variety of foundry-grade print media and binders
- Automation, Industry 4.0, and desanding options
- Build volume 1,260 l and double job box available

### The Benefits of Sand 3D Printing

- Eliminate the cost, lead time, and storage of hard tooling
- Increase innovation, iterate freely, and get to market faster
- Design freedom to consolidate complex cores and integrate organic rigging for less scrap
- Complete systems, application development, and on-demand production

## Ventana 3D Printing Sandcastings

### MACHINE

S-Max / S-Max Pro

### APPLICATION

Lightweight aircraft door hinge

### MATERIAL

Magnesium

### SIZE

600 x 450 x 300 mm

### ABOUT VENTANA

VENTANA Group, present in France, Austria, Sweden, Tunisia, and Portugal was created in 2003 and has since seen strong organic growth and simultaneously broadened its technological expertise. The Group now consists of 13 companies divided into 3 divisions (mechanical, meca weld and foundry) with complementary synergies, in an integrated and evolving organization. Thanks to strong independent shareholders, VENTANA has invested more than 20 M€ over the last 10 years to prepare the future to be at the service of its customers. Our mission: to conceive and implement efficient manufacturing processes, which are increasingly more respectful of people and the environment, for your high value added metal components & sub-assemblies. By choosing to work in partnership with the VENTANA Group, you will be participating in a unique manufacturing experience made of sharing and fulfillment. Whether you are a project sponsor or are looking for a motivating professional experience, we are here to listen to your needs and suggestions.

### ABOUT EXONE

ExOne is the pioneer and global leader in binder jet 3D printing technology. Since 1995, we've been on a mission to deliver powerful 3D printers that solve the toughest problems and enable world-changing innovations. Our 3D printing systems quickly transform powder materials – including metals, ceramics, composites and sand – into precision parts, metalcasting molds and cores, and innovative tooling solutions. Industrial customers use our technology to save time and money, reduce waste, improve their manufacturing flexibility, and deliver designs and products that were once impossible. As home to the world's leading team of binder jetting experts, ExOne also provides specialized 3D printing services, including on-demand production of mission-critical parts, as well as engineering and design consulting.

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