



#### FORMLABS CASE STUDY:

# Reducing Costs and Lead Time in Manufacturing with Next-Day Custom Jigs



#### COMPANY:

Pankl Racing Systems

#### INDUSTRY:

Manufacturing

#### PROFILE:

Pankl Racing Systems, a subsidiary of KTM Industries, specializes in developing and manufacturing engine and drivetrain components for racing cars, high performance vehicles, and the aerospace industry, with subsidiaries in Austria, Germany, UK, USA, Slovakia, and Japan.

#### CHALLENGE:

Producing gears for motorcycle gearboxes requires a large number of custom jigs, which require long lead times using traditional methods.

#### SOLUTION:

By using Form 2 stereolithography 3D printers, Pankl managed to produce jigs within 24 hours, make adjustments, and use the parts directly on the manufacturing line.

#### RESULTS:

- 90% reduction in lead time, from 2-3 weeks to less than a day.
- 80–90% cost reduction, leading to €150,000 in cost savings.
- The 3D printed parts fulfilled the requirements of the demanding manufacturing environment.

## Profile

Pankl Racing Systems specializes in developing and manufacturing engine and drivetrain components for racing cars, high performance vehicles, and the aerospace industry.

The company recently opened a €36 million state-of-the-art manufacturing facility in Kapfenberg, Austria, and is in the process of ramping up production of entire gearbox assemblies for a well-known motorcycle manufacturer.

Manufacturing these gears is an elaborate process. Forged steel parts go through multiple stages of machining using automated lathes, followed by heat treatment and stress relief. Each stage of turning in the automated lathes requires custom jigs for every individual gear type, and these jigs are normally machined from metals. The result is a proliferation of custom tools, adding significant cost and complexity to the manufacturing process.

Due to an increase in order volume, Christian Joebstl and the process engineering team at Pankl would have faced a substantial delay if they opted for the traditional route and outsourced the production of these jigs. By using in-house 3D printing, however, the team managed to rapidly manufacture hundreds of custom jigs for a fraction of the cost, saving weeks of lead time.



Jigs are 3D printed in batches using Formlabs Tough Resin.



Process engineer Christian Joebstl runs three Form 2 SLA 3D printers in Pankl's production facility.

## Challenge

Pankl was selected to manufacture gearboxes for multiple motorcycle lines in 2016, and swiftly began to set up the new production facility. The team started by planning the manufacturing process for the various parts. Then, they sourced information from the machine suppliers, ordered the required equipment, and at last began to design and order all the toolings, jigs, and fixtures.

Meanwhile, Pankl's customer increased its order volume substantially. Pankl now needed to produce more than a dozen different gearbox models, each with about 10 gears. Producing each of these individual gear types requires turning in three automated lathes, each consisting of two working stages. Each stage requires a custom jig, so Pankl would need more than 1,000 custom jigs.

"Our schedule was tight, because we had to produce many more gear types than expected. By the time we got to designing and ordering toolings, we were already supposed to start producing the first acceptance lots."



Each jig is printed with a unique identifier on its side.

## Solution

The team at Pankl purchased its first 3D printer about a year ago, and now runs three Formlabs Form 2 stereolithography (SLA) printers within its Racing Division. So far, the machines have been used in applications as diverse as fabricating jigs, prototyping connecting rods, and building grips for robot arms.

The engineering team chose 3D printing to manufacture jigs for the new production line primarily due to the time constraints, and to a lesser extent, costs. Outsourcing jig production to a service provider would have involved finding a supplier, communicating back and forth about the models and specifications, and then waiting for production.

“We couldn’t just design the custom jigs and get them next day. By outsourcing to traditional machining service providers, we would have had to wait six more weeks before we could start production. With 3D printing, you can simply take the same design, send it to the printer, and then have the finished part ready by the next morning. This leaves time to check the part on the manufacturing line, and make changes if need be.”

3D printing also simplified the design process, providing the design freedom to produce jigs in any shape. In conventional CNC milling or turning, engineers are constrained by the need to design machinable parts, and every extra curve, hole, or chamfer adds complexity to the process.



Each working stage in the automated lathe requires a custom jig. The jigs are attached to the conveyor belt using shuttles.

## Results

Joebstl and team can now print a single jig in 5–9.5 hours, and about 40 jigs within a week by running all three Form 2 3D printers. A simple machined jig costs about €40–50, but more complex parts can cost up to €300. 3D printing reduces these direct costs to €8.5–25, and significantly lowers overhead costs in design, purchasing, and storage, resulting in more than 90 percent overall cost reduction. Considering the more than 1,000 jigs Pankl will need to produce over the course of production, 3D printing will help the company save more than €150,000 in production costs.

Most importantly, the 3D printed parts have fulfilled the requirements of the demanding manufacturing environment.

“We’ve had lots of problems in the past because the cooling media in the lathe is very aggressive to plastic parts, and makes them brittle after some time. Parts 3D printed with Tough Resin have shown resistance against our cooling media, and they are strong enough to withstand the intermittent load that these parts have to endure. Holes and length tolerances normally lie within the  $\pm 0.1$  mm interval, which satisfies the requirements for our jigs.”

Pankl has already produced more than 300 3D printed jigs and is now in the process of manufacturing small batches of 200 parts of each gear for the trial production run. Once the company scales up production, batch sizes will increase to 1,000-2,000 parts, and the production capacity of the facility will increase to more than 1.5 million gears per year.

APPLICATIONS	TRADITIONAL MACHINING	PRINTING ON THE FORM 2
 <p><b>Custom Jigs</b></p>	<b>Cost</b>	€40-300
	<b>Lead Time</b>	2-3 weeks
		€8.5-25
		5-9.5 hours



A machine picks up the parts from the first jig, and places it on the second jig once the machining process is complete.



The finished parts are manually removed and cleaned of metal chips.



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