

CASE STUDY

ALPINE

F1® TEAM

ALPINE
F1® TEAM

JABIL

OFFICIAL SUPPLIER

COMPANY

Alpine F1® Team

INDUSTRY

Auto Racing

COUNTRY

United Kingdom

WEBSITE

alpinecars.com

CHALLENGES

- Incredibly fast pace of designing and manufacturing F1 car parts is measured in hours and days
- Continuous cycles of improvement required to manufacture parts that are lighter, stronger and reliable under the harshest conditions
- Innovation in additive manufacturing materials, machines and processes needed to ensure design freedom while expediting production of on-car parts

SOLUTION

- Jabil Additive offers scale and diversity of experience and capabilities to meet tight deadlines and rapid turnarounds
- Jabil Workcell Model provides Alpine F1 Team with dedicated support and expert advocacy
- Jabil Materials Innovation Center offers hub of new polymer and metallic formulations

BENEFITS

- Alpine F1 Team uses additive manufacturing to make components within car exhaust systems, engines, aerodynamics, hydraulics, cooling, electronics and brackets
- Ability to design part geometries and topologies for maximum performance that couldn't be produced any other way
- Unprecedented speed and agility in delivering new and spare parts provides Alpine F1 Team with a competitive edge



Alpine F1 Team Champions Additive Manufacturing to Fast-Track Innovations in Elite Auto Racing

Long-time collaboration with Jabil Additive drives delivery of lighter, stronger 3D-printed parts and a winning strategy for increasing speed and agility

Nowhere is the need for speed more evident than Formula One (F1) auto racing, where the fastest, most technologically advanced cars in the world go from 0 to 60 mph in less than three seconds while hitting top speeds of about 220 mph.

For more than 60 years, F1 has set the pace for innovations in race car performance. While estimates vary, tens of thousands of discrete parts can be found in a typical F1 car. Together, many of these car parts introduce new marvels of engineering that exceed expectations for speed and agility, including how they are designed and made.

Leading-edge 3D printing machines, materials and processes have long been embraced by F1 teams to

aid in the production of lighter, stronger, stiffer and more efficient parts. For Alpine F1 Team, additive manufacturing fuels breakthrough performance at every turn, including the team's first F1 victory of the 2021 season. When the checkered flag waved for Alpine F1 Team driver Esteban Ocon as the victor at the Hungarian Grand Prix in Budapest on August 1, 2021, the additive manufacturing team also chalked up a major win.

According to Pat Warner, Advanced Digital Manufacturing Manager for Alpine F1 Team and a longtime 3D printing proponent, the team is always looking for the next step in reliability and power. "Additive manufacturing is a great fit for race car components," Warner explains. "We use additive manufacturing extensively. There are components within our exhaust system, engine, aerodynamics, hydraulics, bracketry, cooling, electronics — there's quite a range of materials and technologies available to us now."

Leading-edge 3D printing machines, materials and processes have long been embraced by F1 teams to aid in the production of lighter, stronger, stiffer and more efficient parts.

Timing is Everything

In a sport where winners are measured in milliseconds, the lifecycle of certain parts can be calculated in hours or days. Aside from weight, there's a long list of factors to consider, such as how well a part's shape or material performs under harsh conditions. "Formula 1 is an aggressive environment," Warner says. "The G-force is huge while temperatures can be high, depending upon where the part is on the car. All of these parts have to withstand pressures and cycles throughout the course of a race."

Time is of the essence. When new parts need to be designed, developed and delivered to a racecourse for installation into a car being driven that day, there's very little margin for error. Meeting the need for on-demand spare parts also requires expedited production. Overall, this incredibly fast pace demands a level of agility and responsiveness not associated with traditional manufacturing, where developing prototypes, molds and fixtures to guide conventional processes can take months or even years.

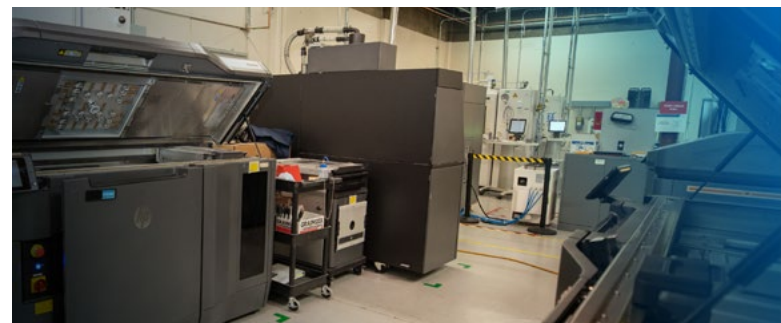
Such was the case for a recent test drive in Europe. When Alpine F1 Team contacted Jabil in preparation for an event happening in a matter of days, needing specific parts to make the test worthwhile, the Jabil team quickly got to work. "We jumped on the parts right away, built them in a matter of days, inspected them and got them ready to go," recalls Brett Lyons, Director of Engineering for Jabil Additive. When the team brought the parts to a courier shipment service, however, it was already too late. "Knowing how valuable time is to Alpine F1 Team, we took one of our engineers and put him on a plane," he adds. "He carried the parts over to them in order to meet their schedule and delivery."

Aside from significant time constraints, F1 teams also must meet specific requirements for aerodynamics, weight, durability, and other strategic considerations. "There are many things an F1 team has to get right to be successful," says Bob Bell, Strategic Adviser to Alpine F1 Team. "One of the most important is actually

producing a car that is reliable, consistent, and as light and stiff as we can possibly make it, while ensuring the components operate at maximum effectiveness."

To that end, F1 teams often experiment with different part shapes and sizes to improve performance. "Additive really works for F1 because it gives us creativity not bounded by the rules of CNC machining and traditional parts manufacturing," explains Ian Goddard, Head of Technical and Innovation Partnerships, Alpine F1 Team. "We can optimize the design, weight, structure and get really creative with unique geometries and topologies that you just can't do with anything else."

Continuous improvements in additive manufacturing materials, especially those used in aerospace and other parts of the automotive industry, also introduce new opportunities for optimizing design. The overarching challenge for most F1 teams, however, is addressing the rapid evolution of increasingly sophisticated additive materials, machines and processes that are transforming the entire industry.



“Additive really works for F1 because it gives us creativity not bounded by the rules of CNC machining and traditional parts manufacturing. **We can optimize the design, weight, structure** and get really creative with unique geometries and topologies that you just can't do with anything else.”

IAN GODDARD

Head of Technical & Innovation Partnerships, Alpine F1 Team



Engineering for Excellence

For Alpine F1 Team, the longtime collaboration with Jabil Additive amplifies the team's ability to move quickly and decisively when it comes to fulfilling the ongoing pursuit of innovation. Since 2017, Jabil Additive has worked with Alpine F1 Team to build and execute a solid roadmap for success. "Jabil understands that our requirements are intense and that's quite brilliant," Warner says. "They're like an extension of our team, which allows us to develop new parts at quite a high rate."

This accelerated pace reinforces Jabil's ability to be responsive and increasingly nimble. "Working with Alpine F1 Team has been a fantastic experience that really pushes us to respond as fast as physically possible," Lyons explains. "They have discreet technical requirements in keeping with weekly or biweekly race schedules, which requires parts to be delivered in days."

Jabil Additive engages with Alpine F1 Team to drive engineering excellence, participating in deep-dive technology explorations, new 3D printing machine evaluations and co-development of next-generation additive materials, as well as manufacturing process development and final-part production. "What attracted us to Jabil was the scale and diversity of its operation,

along with the drive to innovate and move forward in manufacturing," Bell notes. "We are always looking for the next manufacturing innovation, and Jabil shares that same outlook."

Jabil has invested in high-temperature, high-performance polymer and metal additive manufacturing machines for printing materials ideally suited for aerospace, Formula 1 and medical applications. All the requisite post-processing and quality inspections are handled on the back end to achieve the best possible results. "A lot of the processes we use within the factories to develop the car are crucially dependent on additive techniques," Bell adds. "We make jigs, tools and fixtures as well as the components themselves. So what you see on the race car is only the tip of the iceberg for other uses of the technology."

“ We make jigs, tools and fixtures as well as the components themselves. So what you see on the race car is only the tip of the iceberg for other uses of the technology. ”

BOB BELL

Strategic Adviser to Alpine F1 Team



Alpine F1 Team also benefits from Jabil's Workcell business model, which dedicates a personal advocate to help manage costs as well as delivery schedules. This unique management structure ensures that Jabil's global manufacturing capabilities and strengths are applied in the most efficient manner to accommodate tight design deadlines and rapid manufacturing turnarounds.

The Jabil Additive Manufacturing network runs a rigorous set of processes deployed across more than 200 machines running seamlessly at state-of-the-art facilities within the U.S., China, Hungary, Mexico, Singapore and Spain. "We put a lot of effort into maintaining Jabil's AS9100, along with ISO 9001 and ISO 13485 quality management certifications, as they form the foundation for delivering the best outcomes, consistently and repeatedly," Lyons says.



Collaboration Fuels Innovation

Formula 1 racing is a high-stakes sport where millions of dollars and engineering hours are spent studying every aspect of aerodynamics and mechanical performance of the car. Fastidious attention is paid to the effects of weather and track conditions as well as the impact of different part geometries on weight, speed and durability. An enormous amount of collaboration and calibration among different experts is required to understand each environmental and geometrical variable that can be improved using innovation, materials, product designs and manufacturing processes.

The ability to produce new parts in hours or days throughout the racing season can have a direct correlation with winning or losing individual races and overall championships. So, the never-ending quest is to find ways to make better parts faster and with less waste. "You always want to optimize the part for the ultimate job," Goddard says. "What are we replacing? Is it a traditional metallic part or a composite part? Maybe it's a hybrid part. It comes down to re-engineering traditional parts using additive metallics that really enable us to do something different."



Together, the collective group is looking at novel materials and manufacturing methods to achieve something that could not be accomplished previously. “Working with Jabil Additive enables us to tap into their expertise in developing next-generation materials for our needs,” Warner adds. “The Jabil team is very good at understanding what we require from the material, but also where it’s applicable in other industries, such as aerospace. We can test new materials upfront, which is a key advantage for us.”

At Jabil, materials scientists and engineers are creating, formulating and producing new polymer and metallic materials in partnership with Alpine F1 Team. Not only do these materials offer unprecedented design freedom; they enable the development of other light yet durable parts for a variety of applications and different environmental conditions.

The culture of collaboration permeating this valued partnership is a barometer for what lies ahead in continuing to set new standards of excellence and innovation using additive manufacturing. “We’ve got a great relationship with Jabil,” Bell concludes. “We can pick up the phone and say, ‘Hey, we’ve got this problem,’ and get instantaneous support. In our

industry, we live or die by agility and speed, so having a partner that gives us agility, flexibility and access to emerging technologies is really crucial.”



“ The Jabil team is very good at understanding what we require from the material, but also where it’s applicable in other industries, such as aerospace. We can test new materials upfront, which is a key advantage for us. ”

PAT WARNER

Advanced Digital Manufacturing Manager, Alpine F1 Team

Jabil (NYSE: JBL) is a manufacturing solutions provider with over 260,000 employees across 100 locations in 30 countries. The world’s leading brands rely on Jabil’s unmatched breadth and depth of end-market experience, technical and design capabilities, manufacturing knowhow, supply chain insights and global product management expertise. Driven by a common purpose, Jabil and its people are committed to making a positive impact on their local community and the environment.