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Not just a supercar but a hypercar – engineering innovation is key to the Motion's impressive 0-60mph in under 2.5 seconds

When Russ Wicks, one of few people to have set records of more than 200mph on land and water, set his sights on producing a supercar like no other, he was determined to incorporate state-of-the-art automotive engineering and applied science materials with the latest advanced technologies available to produce a road car with unprecedented performance, style, safety, and efficiency. He linked with Kepler Motors and produced the Motion, which features an innovative hybrid drive concept.

The rear wheels are driven by a modified Ford EcoBoost 3.5 litre V6 engine which produces a stated 550bhp. Two REMY electric motors are mounted on the front axle, totalling 250hp delivered to the front wheels. The combined 800bhp launches the car from 0-60mph in a quoted 2.5 seconds, giving it extraordinary performance

What makes this hypercar unique (and exclusive as only 50 are to be produced) and so impressive is the engineering innovation. Rather than adapting previously designed high-performance cars, the Kepler engineers and aerodynamicist analysed each component and material going into the design of the hypercar with the objective of obtaining peak performance.

From the beginning of the design process, the engineering team knew they would incorporate additive manufacturing for the production of low-run parts. However, what they discovered was additive manufacturing could be used to produce 3-D printed patterns for investment casting.

This capability prompted the engineering team to re-evaluate and re-design parts without traditional manufacturing limitations. Leverage additive manufacturing technology allowed the team to create a cast titanium upright. Kepler

Main picture: Kepler Motors are hand-assembling only 50 of their Motion high-performance cars
Above: 3-D printing, rapid casting and precision CNC machining allowed engineers on the project to design intricate parts

The Motion sits on a carbon-fibre composite monocoque chassis and body, F1-style double wishbone, and pushrod suspension with cast titanium uprights

The upright of the Motion was designed to withstand the loads from all components effectively with minimum weight

Motors sought out experts with Formula 1 and additive manufacturing technology know-how to assist with the cast uprights. The Kepler team quickly came to view the CRP Group as the vendor of choice.

By partnering with CRP Group, Kepler Motors was tapped into a network of companies that could provide a custom solution. Two specific divisions within CRP Group were placed on the project team: CRP USA and CRP Meccanica. CRP USA coordinated the project between Kepler, the various divisions within CRP Group, and the design consultants, leveraging their Formula 1 and additive manufacturing expertise. CRP Meccanica was selected for the project to provide cooperative design expertise for the uprights, as well as guidance on how to combine the use of additive manufacturing, rapid casting and precision CNC machining.

More and more, designers, engineers and manufacturers are examining the potential of using additive manufacturing technology to 3-D print parts for low-run production of parts. The perception of how to design for manufacturing is changing.

'It is very common for a company to rethink their design as soon as they understand the potential with 3-D printing,' said Stewart Davis, Director of Operations, CRP USA. 'Once an engineer understands the possibility of manufacturing highly-complex designs and shapes using additive manufacturing technology and applications, shapes that could not be manufactured by traditional processes, they begin designing without limitations. By combining 3-D printing, rapid casting and precision CNC machining, engineers can think outside of traditional manufacturing methods and design complex, intricate parts.'

In order to remove preconceived design elements, Kepler Motors engineering director Derk Hartland focused on designing the hypercar from the inside out. Knowing what they wanted to achieve, the Kepler design team knew they would need to look at alternative manufacturing methods to achieve the quality and innovative hypercar they envisioned.

The innovative Motion is designed with best-in-class features. Along with its impressive performance figures, the Motion sits on a carbon-fibre composite monocoque chassis and body, F1 style double wishbone, and pushrod suspension with cast titanium uprights.

The cast titanium uprights are just one component that makes the hypercar unique. Because the suspension of this hypercar is exposed to all of the loads associated with cornering, downforce, braking and acceleration (which can occur in various combinations with each other), the uprights connect the wheel and half-shafts to the wishbones – one of the most complex and critical parts of the car. Multiple load scenarios were used with Finite Element Analysis (FEA) to ensure an optimal design that is strong, lightweight and elegant.

Along with strength, weight is a critical aspect of any car's suspension. In the case of the Motion hypercar, the suspension performance is critical. The upright of the Motion was designed to withstand the loads from all components effectively with minimum weight. The shape is complex as it secures multiple components.

'Lightweight strength and durability is essential for the hypercar to achieve its performance,' says Wicks (who founded Kepler Motors). 'Cast titanium is top-of-the-line technology for this application, which for the Kepler Motion was the only choice. Other cars use aluminium cast or billet for this application with a bulky, weaker and heavier result.

'Typically, aluminium is used for the uprights and the material thickness is increased, which reduces the flexibility of the design,' says Wicks. 'Because of the increased material thickness, accuracy of the machining is critical to ensure correct positioning of components as well as complicated angles of machined faces. This makes CNC machining imperative, yet can restrict our design creativity.

'Working with CRP Meccanica allowed us to streamline the process. Using their laser sintering additive manufacturing technology to 3-D-print the pattern for casting the upright in titanium allowed us to design an optimal lightweight and strong part with no compromises. CRP Meccanica managed the entire production process – from design to finish. They took the 3-D printed upright patterns to the foundry, cast the upright patterns in titanium, precision CNC machined the titanium uprights, conducted the FEA analysis and inspected the final uprights. The results were better than we could have imagined.'