

Motorcycle Maker Accelerates Engine Design with FDM Prototyping

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- Piero Giusti, Ducati

Founded in 1926, Ducati builds racing and racing-inspired motorcycles characterized by unique engines, innovative design, and advanced engineering. The company has amassed a string of World Superbike Championships on the track, and it offers some of the most sophisticated bikes on the road.

Real Challenge

One of Ducati's key challenges is to reduce time-to-market for new products by reducing the design cycle. To help meet this challenge, the entire design process is validated using FDM prototyping systems from Fortus. FDM (fused deposition modeling) enables Ducati to build both concept models and functional prototypes from ABS, polycarbonate and polyphenylsulfone.

Real Solution

By bringing FDM in-house, Ducati cut 20 months from the development process of the engine designed for its Desmosedici race bike. A flagship success for the design team, the Desmosedici engine was designed and assembled in only 8 months. The company's previous engine had taken 28 months to design and build, when the majority of prototypes were outsourced to service bureaus.

Ducati wanted the Desmosedici to surpass its predecessor by providing the additional power necessary to continue its success in the MotoGP race series. Using two FDM prototyping systems, the design team built a prototype engine composed almost entirely of polycarbonate components. The design included a twin-cylinder oval-piston configuration, which engineers considered the best layout to add power while complying with MotoGP regulations. The engine would have the power and torque of a conventional twin-cylinder engine and have the additional performance necessary to compete with the multi-cylinder engines.

Then a change in strategy led engineers to reconsider cylinder configuration and redesign the engine with four round pistons that employ a two-by-two firing order that reproduces the working cycle of a twin-cylinder engine. The four pistons were configured in L-shaped layout. This meant it would comply with existing MotoGP



Image 1: The Desmosedici motorcycle.

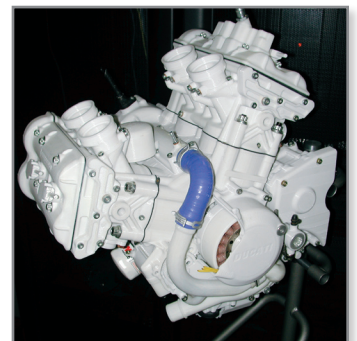


Image 2: The Desmosedici's engine was prototyped almost entirely from polycarbonate using the FDM process.

regulations while setting a new benchmark for the international motorcycle industry. The new engine design was again prototyped completely from polycarbonate.

"The accuracy and durability of the models enabled us to physically analyze each component, recognize design flaws, and rectify them quickly," says Piero Giusti, R&D CAD Manager for Ducati Motor Holding Spa. "The FDM prototype engine gave us a more holistic view of the engine design than we've had with previous engines. It decreased the number of errors in the design and significantly sped up the development process.

"Having the polycarbonate prototype engine helped confirm the second design was the right decision. Our design team was able to quickly eliminate any technical concerns. More importantly it was able to present the whole engine prototype to the organization and gain buy-in for its vision of the double twin-cylinder design.

"Prior to purchasing the [Fortus] prototyping systems, our service-bureau expenses totalled approximately 1 million euro per year. That was much higher than the cost of purchase, maintenance, and materials for the two FDM machines. Not only can we produce higher quantities of parts at a fraction of the cost, but we are also able to forecast costs for each project much more accurately.

"To keep Ducati at the forefront of engine design, we sought a technology that could make accurate, durable prototypes quickly," says Giusti. "FDM was the only solution that could meet our requirements. The machines were as easy to install as a printer and they now constitute an integral part of our design and manufacturing process. Stratasys has demonstrated real commitment to our business, and we continue to receive expert advice from them.

"If you want to win the race, it's imperative to drive technological innovation throughout the organization. Our partnership with Stratasys has contributed to Ducati being regarded world-wide as an innovator in the field of motorcycle manufacturing."

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