

WITH DAVID CRAMER



## Cramer is positioning Fiberforge as a bridge technology to wholly different vehicles

A college project to create an electric vehicle for the local police department introduced David Cramer to alternative transportation back in 1993. As he loaded battery upon battery into the car, eventually reaching 24, Cramer quickly realized he could complete his assignment, but that electric vehicles, as they were, would never get an "A."

His curiosity piqued by the shortcomings of the current technology, upon graduation Cramer joined the Rocky Mountain Institute (RMI; Old Snowmass, CO), and began work at the cutting edge of alternative vehicle technology.

Founded by Amory Lovins, RMI is an energy-efficiency think tank focused on increasing usage of sustainable energy technologies—with a fixation from its founding on the internal combustion engine and its wanton use of gasoline—culminating in a recent manifesto against the fossil-fuel based economy, "Winning the Oil Endgame."

At RMI, Cramer joined a team taking a "holistic" approach to an alternative vehicle, designing a car from the ground up and aiming to appeal to car buyers' eyes and automotive OEMs' bottom lines, and not just a sense of environmental responsibility.

structures, which was spun off as a stand-alone company called Fiberforge (Glenwood Springs, CO), with Cramer as the VP of engineering (see p. 52 for more).

In recent years as progress was made with alternative drive systems like fuel cells and hybrid technologies, Cramer says automotive OEMs applied a "new-wine, old-bottle" approach, forcing the latest drive technologies into older vehicle substructures that still relied heavily on steel.

"Right from the outset," Cramer says, "we started looking at composites. If you can start [in the body] with a lightweight yet strong and safe structure, then you're setting out on the right course."

Composites currently see broad use in high-end, high-performance cars, but Cramer and his team felt that as has happened in the past, technology that was once the exclusive realm of luxury vehicles could trickle down to mass market cars, especially if they could move away from the short-run, artisan, hand-layup composites found in Ferraris and the like. The goal soon became a highly repeatable process capable of vehicle runs of 50,000 or more/yr, using a system that applies continuous lined-fiber laminates in a high-throughput, low-scrap

**Making composites economically palatable for OEMs, and attractive to consumers, is the mission driving Fiberforge.**

Out of that research, an immediately commercially viable technology arose for the quick, cost-effective manufacture of composite

method with shorter cycle times than conventional technologies.

From that impetus, Fiberforge and its tailored blanks were created. The blanks consist of multiple plies, layering thermoplastic resins and fibers, in what Cramer jokes is like a "computer-controlled composite printer." Precise control of fiber orientation greatly enhances strength.

Ultimately the vision, for which patents were awarded, entails a system of arrays where multiple material layup heads sequentially put down plies of material, creating tailored blanks in 30 seconds, including through-holes and other design features.

The current concept was recently applied by Tier One supplier Johnson Controls, in conjunction with Fiberforge, for a seating system.

Cramer feels the technology has wide applications within automotive, and also in a slew of other industries, but part of the challenge of creating new business is promoting the process as having the mechanical benefits advanced composites without the anticipated cost and batch processing.

"We're not trying to compete with automated fiber placement for the Stealth Fighter," Cramer says, "because they're willing to pay for the ultimate composite. If we can be 80% there, we think there will be 100 times the market, 1000 times the market."

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