

CARR ENGINEERING, INC.

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Technical Biography for Dan Barnes

I am a resident of the State of Texas and an employee of Carr Engineering, Inc. (CEI), a Texas corporation at 12500 Castlebridge Drive, Houston, Texas 77065. I received my bachelor's degree in Engineering with distinction from Harvey Mudd College in Claremont, California, in 1998. The general Engineering degree offered by Harvey Mudd College in 1998 was based on a core curriculum uniting mechanical, electrical, thermal and chemical disciplines under a common set of mathematical analytical tools and methods, along with hands-on laboratory work.

Beginning in 1995 and continuing through 2005, I worked as an automotive journalist for magazines including *Four Wheeler*, *European Car*, *Sport Compact Car*, and *Road & Track SPEED*. In addition to evaluating the ride, handling, performance and driveability characteristics of new and original vehicles, these titles dealt extensively with alteration of vehicles' capacities in all realms of "go, stop and turn." It was fundamental to understand not only *what* the results of changes were in objective and subjective evaluations, but *why* those changes led to the observed results.

In 1997, I worked at AeroVironment, Inc., a leader in the development of Unmanned Air Systems (UASs) and energy efficient vehicles. From 1998 to 1999, I was an Associate Engineer at Advanced Projects Research, Inc., where projects centered on combustion research and aerospace propulsion technology development.

In 1999, I chose to dedicate myself to automotive technology and engineering full time and began working as Engineering Editor of *European Car*. I focused on suspension and tire technology, visiting test and manufacturing facilities and interviewing engineering personnel across North America and Europe, in addition to extensive hands-on installation and testing.

Throughout 2004, I was a manager at Shoreline Motoring, a premium retailer and installer of luxury and performance automotive equipment in Huntington Beach, California. My role included ensuring technically correct selection, application and installation of products. I was certified by Michelin to service its PAX run-flat tire system.

I returned to publishing as Technical Editor of *Road & Track SPEED*, until at the end of 2005, I was invited to join StopTech, a manufacturer of high performance brake systems, where I was responsible for product management, selecting and specifying new product applications and promoting enhancements to the product line. I provided support to all professional-level racing partners, including championship winning teams in such series as SPEED World Challenge and Grand-Am Cup.

In 2007, I was made OE Program Manager for StopTech. I led foundation brake system development and productionization for OE customers and investigated product defect claims, while also continuing to specify specialty brake system applications and support motorsport activities, including development of applications and products for off-road racing. My role was

instrumental in the operational improvement program leading to ISO/TS 16949 quality system certification.

From 2013 until the present, I have been employed as a Senior Engineer at CEI. In this capacity, I measure and analyze vehicle performance, including handling, acceleration and braking capacities both in limit and typical driving scenarios. I analyze product defect theories, including areas of structures, mechanical design and materials. I have conducted industry-wide surveys of vehicle technology, equipment, and operational characteristics in such areas as brake assist vacuum supply, throttle position sensor characteristics, Not-In-Park responses, and automatic engine shutdown features.

In addition, I reconstruct and analyze the conditions, causes and circumstances of vehicle crashes, including the role and effects of the humans, vehicles and environment before, during and after a crash. I conduct crash scene and vehicle inspections to gather evidence and understanding, using a variety of techniques and technologies. These include Total Station survey equipment, Faro laser scanners, conventional measurements, and photography, both ground-based and with UASs. I have applied photogrammetry methods ranging from automated 3D to manual 2D. I analyze Event Data Recorder (EDR)-type information from a variety of onboard vehicle systems and am qualified to conduct EDR imaging using the Bosch CDR system.

In addition to professional activities, I have undertaken maintenance, repair and modification of personally owned vehicles. I have participated in motorsports, starting with high performance driving events (HPDEs), moving on to providing on-track driving instruction to others and ultimately racing, both as driver and support crew. Off the pavement, I have explored mountains, dunes and deserts, on four wheels and two.

Over the course of my professional career, I have acquired nearly 30 years of automotive and engineering experience in motor-vehicle related areas including component design, vehicle dynamics, performance modification, failure analysis, and crash reconstruction.