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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. Over the course of my professional career, I have acquired more than 20 years of automotive and engineering experience in motor-vehicle related areas including component design, vehicle dynamics, performance modification, failure analysis, and crash reconstruction.

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. This foundation was built on a bedrock of mathematics, physics including introductory quantum mechanics, electricity and magnetism, chemistry, and biology. The breadth included materials, dynamics and kinematics, electronics and computer science, along with considerable hands-on lab work, all without neglecting traditional classical education. The objective was to produce well-rounded graduate engineers who were prepared to develop exceptional capabilities in any engineering discipline.

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," focusing on operation in extreme maneuvers and environments ranging from off-road terrain to race tracks. It was fundamental both to understand and to clearly communicate in lay persons' language 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, where I manufactured development and flight components for micro air vehicles and high-altitude, solar-powered UASs using a variety of composite materials and techniques. 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 ranged from personalized interaction with sophisticated clients in the showroom to getting my hands

dirty, 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 in 2005 as Technical Editor of *Road & Track SPEED*, with renewed passion to entertain, educate and inspire readers to undertake their own automotive adventures.

At the end of 2005, I was invited to join StopTech, a manufacturer of high performance brake systems, as Marketing Manager. My experience uniquely qualified me to deliver StopTech's technical product message to its customer base. In addition to communications, 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 series such as SPEED World Challenge (now Pirelli World Challenge) and Grand-Am Cup (now IMSA Continental Tire SportsCar Challenge).

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. My role was instrumental in the operational improvement program leading to ISO/TS 16949 quality system certification. I continued to specify specialty brake system applications and support motorsport activities, including development of applications and products for off-road racing.

From 2013 until the present, I have been employed as a Senior Engineer at CEI. In this capacity, 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. I measure and analyze vehicle performance, including handling, acceleration and braking capacities both in limit and typical driving scenarios. I use instrumentation including the Racelogic VBOX system, along with supporting sensor suites and the vehicle CAN interface. I analyze product defect theories, including areas of structures, mechanical design and materials.

From a very young age, I have expressed and experienced craftsmanship and attention to detail in and through mechanical creations. In addition to professional activities, this has encompassed restoration, repair and modification of personally owned vehicles. As soon as I was able, I began to participate in motorsports, starting with high performance driving events (HPDEs) in which I developed my own skills in limit handling and car control, 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. Through more than 20 years of first-hand experience, I have witnessed a great variety of humans and vehicles interacting with each other and with an equally diverse range of environments, with analysis and insight honed by formal engineering training.