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Even before the first carbon fiber sheet is laid out in a racing car, hours of labor will have been expended designing the carbon fiber survival cell, race car components and carbon fiber aero parts. A few decades ago, this would have entailed a lot of trial and error in conjunction with considerable cost in fabricating parts with minor differences in shapes, angle, bends and mass to arrive at the optimum performance with maximum strength and minimal weight.

Nowadays, computer-aided design is the norm, with advanced CFD (computational fluid dynamics) programs being used to precisely design and validate race car components without even using a track for physical testing. During a racing season, the development of a replacement or new version of the teams'™ current car will be in the works, and top-level teams will have in effect a separate team taking charge of this developmental effort. Radical new designs will be explored and the most promising designs will possibly be molded in three dimensions for testing in a wind tunnel. Or engineers will take a look at suspensions to optimize shapes, materials (such as carbon fiber) and movements with the aim of optimizing handling.

But the use of computer modelling is not limited to designing for the newest generation of race cars. Lots of racing teams use CFD and CAE to design and prototype new components as the season progresses. Following a race weekend, designers and engineers debrief the drivers and crew on on what would have gone right or wrong during a race. Obviously, things that went right will go into the records for further reference. Things that went wrong will be picked apart to see what modifications can be made to the race car components so that performance and/or reliability can be enhanced. Sometimes, a modification will not necessarily enhance performance but save time for the pit crew, which is also critical in long races. If a carbon fiber component has been found to be overbuilt, for example, design modifications may make it possible to reduce weight while maintaining performance and reliability. The most minor modifications when taken together will prove to have played a vital role in gaining fractions of a second, which can be the difference between winning the race and being second.

Often, the turnaround time between races is measured in weeks and traditional methods of design and prototyping are simply not feasible anymore. Designing race car components in the computer results in only the best designs being selected for rapid prototyping and production. Testing revised designs with CFD and physics software can help optimize vehicle performance and ensure that the race car components with their carbon fiber bodies are able to perform at speeds of up to 300 kilometers per hour.

From initial concept to final release, computers have provided engineering teams greater control over the design process, up to the point the car and its various race car components are manufactured. Using the latest computer-aided tools, racing teams are now able to produce results in one or two seasons, compared to the old days when several seasons were needed to secure a podium finish.

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