

FLUID THINKING

McLaren Racing's aerodynamicists use CFD to visualise and fine-tune the airflow around the MP4-21



CFD computing technology from SGI is assisting Team McLaren Mercedes to accelerate Formula 1 design and engineering beyond conventional boundaries

WORDS MARK SKEWIS PHOTOS MCLAREN

Powerful new CFD supercomputing systems from Official Supplier SGI are helping Team McLaren Mercedes push back the frontiers of computational fluid dynamics (CFD).

For years, experts have been simulating fluid flow and heat transfer in environments such as Formula 1, aerospace and weather prediction. However, the staggering complexity of the calculations meant that the really big breakthroughs were tantalisingly out of reach. Until now.

"SGI provides Team McLaren Mercedes with CFD computing power that would once have been beyond an engineer's wildest dreams," says Jerry Cockeram, SGI's Account Manager for Manufacturing and Defence Systems. "What we are achieving between us is revolutionary."

The rate of development at Team McLaren Mercedes is astounding. On average, the design of a car component is modified every 20 minutes. CFD allows designers to try potential alterations – and identify the effect they would have – without committing to a costly manufacturing run.

CFD is used primarily to refine the aerodynamic shape of the car's body. It is also harnessed to study the cooling of the engine and brakes and for the design of the engine air intake. The detailed modelling of Formula 1 cars has posed exceptional challenges.

"The CFD models we're using to develop the MP4-21 are up to 10 times larger than those for a typical CFD customer," explains Mark Taylor, Senior CFD Engineer for McLaren Racing.

"Processing and handling such a high level of data creates a very difficult logistical problem." The solution was to install one of the largest supercomputer systems in the UK. It encompasses what Cockeram refers to as "the



crown jewels” of SGI technology: ultra-high performance computing, CFD visualisation and storage, and file management. The CAD model data on which the analysis is based is transferred from the McLaren Racing engineer’s workstation onto the SGI Infinite Storage network used specifically for CFD work. From there, it is accessed via the SGI Graphics Prism, using a desktop system to create a computational mesh. The job is then submitted via an automatic queuing procedure to one of a number of SGI Altix computers, where the mathematical calculations take place.

The resulting files, some taking up tens of gigabytes of disk space, are saved directly back onto the network. From there, they can then be viewed on the McLaren Racing engineer’s desktop workstation.

Throughout the process, the data is accessed directly using the SGI clustered XFS (CXFS) file system. This saves moving large amounts of data across the network.

“By automating much of the process, SGI has been able to speed up work involving our full-car model many fold,” says Taylor. “That’s of enormous value.”

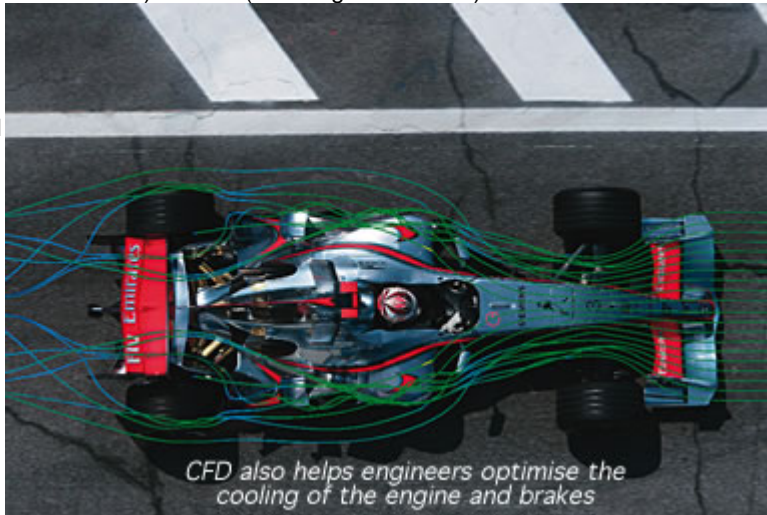
The system was recently further enhanced by the addition of next-generation Altix 4700 computers.

The vast amount of memory in these machines makes it easier for the team to simulate the car not only in a conventional ‘steady state’ analysis but also in a transient state – with the body at angles of yaw (cornering and/or cross-wind), steer (with the front wheels turned) and roll (ride height variations).

Advances in CFD technology mirror Team McLaren Mercedes’ remarkable rate of progress. “The number of computer ‘cells’ we’ve been working with to solve those equations has scaled dramatically. Our ability to do ‘what-if’ scenarios in CFD has also increased considerably,” says Jonathan Neale, Managing Director, McLaren Racing. “CFD technology has been an area of major advance for us in the past two years.”

For SGI, the Partnership brings a real sense of exhilaration and satisfaction.

“Our involvement with Team McLaren Mercedes gives the whole workforce a buzz, as well as offering the perfect showcase for our products,” says Cockeram. “It’s a hugely demanding environment, and we are breaking new ground. But the core values of SGI, like those of the McLaren Group, have always revolved around developing the most audacious technology.”



CFD also helps engineers optimise the cooling of the engine and brakes

About Racing Line

Racing Line is the official monthly magazine from McLaren, providing an exciting and exclusive insight to the Team McLaren Mercedes Formula One team and its prestigious world class group of partners.

The magazine also focuses on the companies which sit under the umbrella of the world famous McLaren Group, including McLaren Cars Limited who in partnership with DaimlerChrysler are producing the Mercedes-Benz SLR McLaren sports car.

Racing Line is produced to the highest standards associated with the McLaren name and is available exclusively as part of Team McLaren Membership. If you would like to receive copies of Racing Line every month, visit http://www.mclaren.com/teammclaren/racing_line.php for more information on the benefits of Team McLaren and how to become a member.

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