IBM Newsroom

IBM and Dallara to Advance AI and Quantum-Powered Design for High-Performance Vehicles

• IBM and Dallara are collaborating on the development of new physics-based AI foundation models.

• One early model was trained on Dallara's proprietary and validated aerodynamic data of a high-performance vehicle.

• Early results show the potential to reduce aerodynamics simulation time from many hours to few minutes and help engineers explore more design options earlier in vehicle development.

• The companies are starting to explore how to integrate quantum computing in the design workflow and further boost simulation fidelity for complex aerodynamic problems.

PARMA, ITALY & NEW YORK, APRIL 30, 2026– IBM (NYSE: IBM) and the Dallara Group, a world-leading racing and high-performance vehicle manufacturer, today announced a collaboration to advance vehicle design and optimization using AI and explore the use of quantum computing. The work combines Dallara's expertise in high-performance vehicle engineering with IBM's leadership in AI for physics and quantum computing to investigate how to accelerate aerodynamic design and open a path to even more advanced simulation workflows.

For more than 50 years, Dallara has designed and supplied high-performance vehicles for some of the world's top racing series, including IndyCar — where track speeds can average more than 230 mph (370 km/h) — as well as Formula 2, Formula 3, Super Formula, and Indy NXT, with additional work in top-tier series such as Formula E, WEC, and IMSA. This breadth of racing programs provides a unique ability to validate simulation results against real-world vehicle performance. Dallara also applies its engineering to high-performance road vehicles and aerospace. These and other distinctive, innovation-driven features of the company were key in IBM choosing to collaborate with Dallara.

As part of the project, IBM has been developing domain-specific foundation models in close coordination with Dallara. The models leverage not only Dallara's high-fidelity aerodynamic simulation data but also the company's deep technical expertise. In a future step, the teams aim to integrate validated measurements of real vehicles in wind tunnels and on the track, but the use of high-quality simulation data alone is already producing compelling early results.

Engineers rely heavily on computational fluid dynamics (CFD), to predict aerodynamic forces and optimize how vehicles perform across components such as body geometry, underfloor, wings, and wheels. These simulations are powerful but computationally expensive. Even relatively narrow analyses may take a couple of hours or more, while full race car development workflows may take weeks or months as engineers iterate through geometry changes, operating conditions, and performance tradeoffs.

IBM and Dallara are using AI to speed up those workflows without replacing the underlying physics. In one early example, which focused on the geometry of a conceptual Le Mans Prototype 2 (LMP2)-like race car, the two companies jointly compared CFD analyses of multiple configurations of the rear diffuser — a part located in the rear underfloor that helps generate efficient downforce and thus grip — with results from the new physics-based AI method.

The traditional approach took a few hours to calculate all the configurations. Meanwhile, the AI model completed the same evaluations in about 10 seconds, identifying the same optimal design with roughly the same error margins as CFD. Applied to a typical complete set of hundreds of geometry configurations, such a speedup could cut days of simulation time down to minutes.

These and other preliminary results suggest Dallara engineers can evaluate more vehicle configurations in a fraction of time to move faster in early design phases, helping focus their most expensive computational resources on deep-dive optimization of race car design and development.

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In early pressure-field modeling of adjusting an LMP2-like race car's rear diffuser angle from -2 to +4 degrees, results from typical CFD (left) and the new IBM physics-based AI approach (right) were remarkably close. Credit: IBM & Dallara.

In parallel, IBM and Dallara are starting to explore how quantum and hybrid quantum-classical approaches could further enhance race car design workflows. By combining Dallara's expertise in high-fidelity vehicle engineering and CFD-driven design with IBM's leadership in quantum computing and AI, the collaboration will evaluate where these methods can complement traditional simulation workflows in the near-term while identifying longer-term opportunities for practical use in automotive and motorsport design.

"Racing has taught Dallara that there are two possible outcomes: you either win or are forced to learn. IBM's close collaboration on this innovative project is a testament of Dallara's willingness to continuously push its boundaries and never stop learning," said **Andrea Pontremoli, Dallara CEO**.

"Some of the hardest engineering challenges come down to accurately simulating the physical world," said **Alessandro Curioni, IBM Fellow and VP, Algorithms and Applications, IBM Research**. "With Dallara, IBM is applying AI to speed up aerodynamic design today while advancing quantum computing in parallel to push simulation farther. Together, these technologies can help engineers move faster, explore more possibilities, and ultimately design better-performing vehicles."

Advancing aerodynamic design with AI

Designing a high-performance vehicle means balancing downforce, drag, stability, and responsiveness across conditions that can change from race to race. Because some parts are designed with exacting precision, even small design changes can lead to surprisingly large impacts on performance, and the best aerodynamic solution is not always obvious.

The AI models are being designed to help predict aerodynamic behaviors directly from geometry and related engineering inputs. As the collaboration progresses, IBM and Dallara plan to expand the AI models across a wider range of conditions, such

as different maneuvers or overtaking scenarios, apply them to design new vehicles and develop tools that enable faster exploration of new aerodynamic configurations, before investing in intensive full-vehicle simulations.

“High-performance vehicles are an ideal proving ground for neural surrogate models, but the potential impact goes well beyond the racetrack,” said **Fabrizio Arbucci, Dallara CIO**. “More efficient designs could benefit all transport categories, from passenger vehicles to aircraft, and even other industries at the mercy of aerodynamics. Even a one to two percent reduction in drag across passenger vehicles could add up to meaningful fuel-efficiency gains at scale.”

Initial results of the collaboration are detailed ina preprint study published at arXiv on April 20, 2026. This work builds upon a new AI model developed by IBM, called Gauge-Invariant Spectral Transformers (GIST), which was described in a March 17th preprint study. IBM and Dallara presented these and other advances in applying AI to complex physical systems on April 26, 2026, at the International Conference on Learning Representations in Rio de Janeiro.

About IBM

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About The Dallara Group

Founded in 1972 by Giampaolo Dallara, Dallara is a world-leading manufacturer specializing in the design, engineering, and production of racing cars for top-tier motorsports. The firm has expanded globally from Italy's Motor Valley with a US Dallara Experience Hub in Speedway, Indiana. Dallara is the sole builder of racing cars for the IndyCar, Indy NXT, Formula 2, Formula 3 and Super Formula Championships, it also supplies Cadillac and BMW in both the WEC and IMSA championships. The expertise acquired in racing is regularly used both in the automotive world through consultancies and production services, with also Dallara branded products like the Dallara Stradale and Dallara^{EXP} and more recently in aerospace. Visitwww.dallara.it for more information.

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