



courtesy of

BOMBARDIER



Success story

Green light to high speed trains

Bombardier reduces aerodynamic drag by 20% and saves about the 10% of energy consumption with modeFRONTIER

*“Rail transportation is a concrete eco-friendly solution for sustainable mobility. Therefore, if we decrease the aerodynamic resistance of our trains, we can increase energy efficiency and further reduce CO2 emissions”, says **Alexander Orellano**, Head of Aerodynamics at **Bombardier**, world leader company in aerospace and rail transportation.*

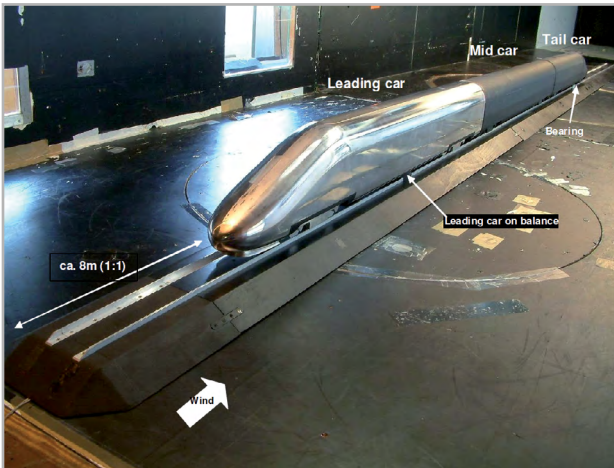
Challenge

Reducing energy consumption implies optimizing the aerodynamic shape of a vehicle, thus inevitably facing two main opposing factors: the best models for drag do not have a good crosswind stability, and viceversa. In addition, high passenger capacity conflicts with optimal aerodynamic shape and elegance and functionality not always go hand in hand. These are some of the reasons that made **Bombardier choose modeFRONTIER**, the multi-objective, multi-disciplinary optimization platform, **for their award-winning ZEFIRO 380 train design.**

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The application of modeFRONTIER to Bombardier high-speed trains leads to a highly competitive product.

Solution

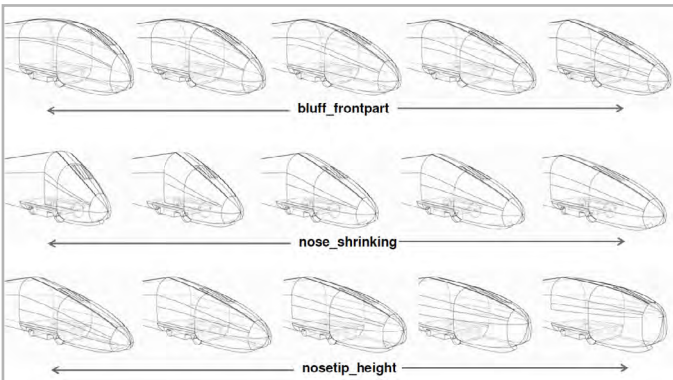


General view of drag measurement.

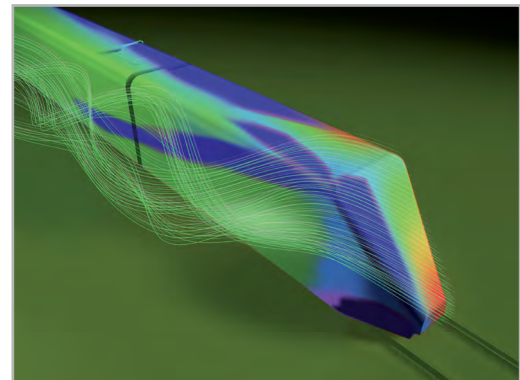
“The application of the multi-objective optimization method to Bombardier high-speed trains leads to a highly competitive product, entailing both to energy efficiency and cost reduction, due to a lower traction power dimensioning”, declared Mr. Orellano. The goal was to find a Pareto-optimal, or trade-off, design which would simultaneously give low drag and good cross-wind stability characteristics. The solution was obtained **using modeFRONTIER**, not only to integrate the various CAE tools in use at Bombardier, but also to **drive the geometry modification and simulation process** providing the necessary graphical tools for the statistical interpretation of results. modeFRONTIER, de-veloped by ESTECO, uses genetic algorithms to determine Pareto optimal solutions, combining 3D models and simulations of aerodynamic drag and cross-wind stability. Bombardier experts considered as many as sixty different design parameters in the modeling phase, taking into account the train’s outer shell, cab, crash structure and ergonomic constraints.

Benefits

The company was therefore able to reduce the aerodynamic resistance by 20%, obtaining a **decrease of energy consumption of about 10%**. By using modeFRONTIER, Bombardier engineers were able to choose from a selection of designs in order to suit particular styling preferences, but secure in the knowledge that each complies with the principles of optimized energy performance and maximum stability and safety.



Example of model variability (3 parameters out of 60).



Zefiro China driving under cross wind conditions.

About Bombardier

Bombardier is a global transportation company, present in more than sixty countries on five continents, which designs, manufactures, sells and supports a wide range of products in the aerospace and rail-transportation sectors. Bombardier is headquartered in Montréal, Canada, and operates in large part of the world. The company is setting a new benchmark in Very High Speed rail travel with the “Bombardier Zefiro” train, the world’s most economical and eco-friendly VHS train, which reaches an operating speed of up to 380 km/h. www.bombardier.com



ESTECO is an independent software company, specialized in numerical optimization and simulation process and data management. With a 20-year experience, ESTECO supports over 300 international organizations (such as Ford Motor Company, Honda, Lockheed Martin, Toyota and Whirlpool), accelerating the decision-making process and reducing development time. esteco.com

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