

Increasing Robustness and Reliability of a Race Car Engine with AcuSolve



prodrive



ASTON MARTIN
RACING

Key Highlights

Industry

Automotive

Challenge

Solve several iterations of a model within a compressed timeframe by inexperienced users

Altair Solution

An automated process generated with AcuSolve

Benefits

The user friendly process automation streamlined the analysis of new geometry

Motorsport is the perfect environment for pushing a car's performance to the limit. Race cars have to be optimised for weight, performance, reliability and efficiency - a process which involves several engineering tasks including Finite Element Analysis (FEA) of components, crash test simulation, optimisation and CFD analysis.

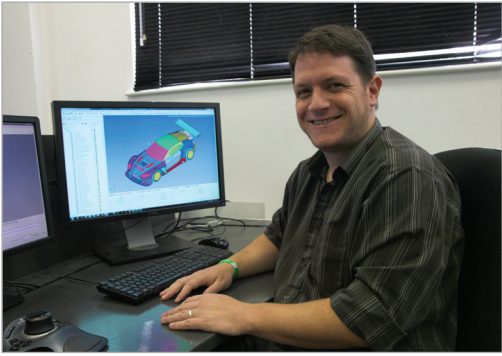
Due to limited development time, motorsport teams require high-end technology which is flexible and cost efficient. This can enable engineers to develop optimised solutions in reduced timescales.

Customer Profile

Prodrive is one of the world's largest and most successful motorsport and technology businesses. For more than 29 years it has been running race and rallying programmes for some of the biggest names in the sport including Aston Martin, BMW and MINI.

Prodrive has run the Aston Martin Racing programme since 2004. The team is fully responsible for all aspects of the programme, from the design and development of the range of GT race cars, to running the works team in sports cars series across the world.

Prodrive Success Story



“AcuSolve's robustness and Altair's customer support enabled us to achieve a level of analysis that really enhanced our problem solving and decision making ability.”

Jonathan Culwick
Senior CAE Engineer
Prodrive

Implementation and Quick Results Through Automation

This study is part of Prodrive's implementation of AcuSolve to enhance its CFD capability after many years of outsourcing these simulations.

AcuSolve is a leading general purpose Computational Fluid Dynamics (CFD) flow solver with superior robustness, speed and accuracy. Users can quickly obtain quality solutions without iterating on solution procedures, and with seamless coupling with HyperWorks structural solvers as standard.

The main target in this study was to analyse and improve the fluid flow within the water jacket of Aston Martin Racing engines and to achieve reliable results in a short period of time. The difficulty in this task was to solve several iterations of a model with complex geometry within a compressed time and done by relatively inexperienced users.

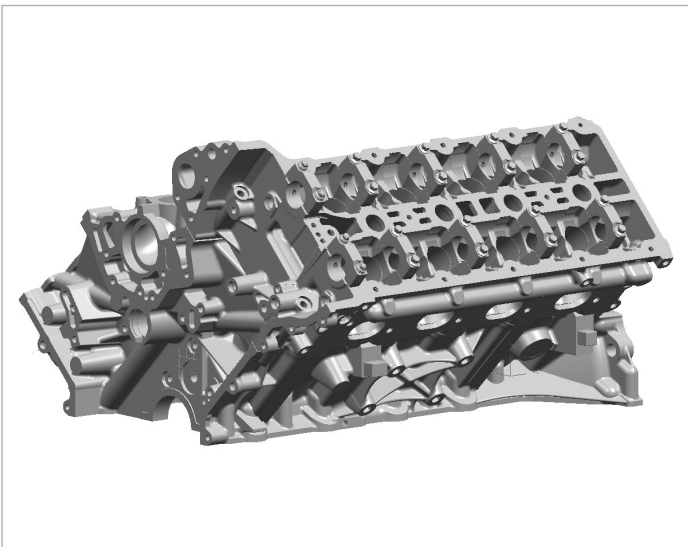
This was made possible by generating a procedure and methodology in AcuSolve that allowed for easy repeatability. This enabled the CAE engineers to generate reports that are forwarded to the relevant

work group, in this case the Engine Development group, for their analysis and result interpretation.

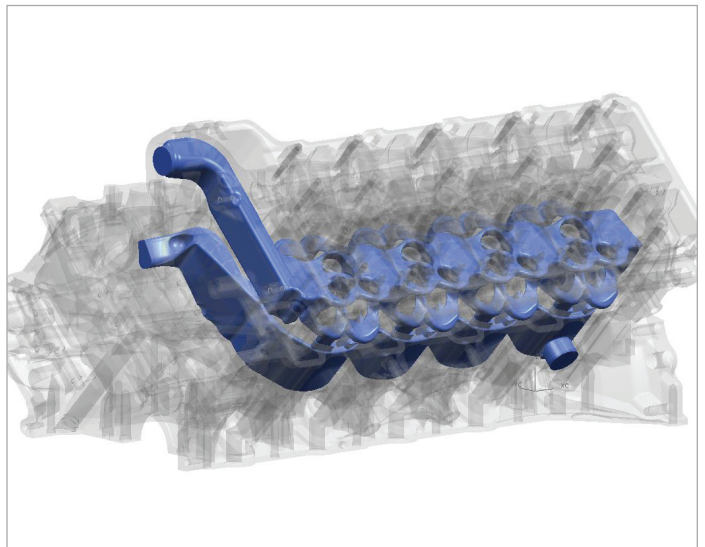
Automated and Streamlined Workflow

The first model in this process was a V8 engine water jacket. One of the challenges of this model was its complexity and level of detail due to the cavities of the casting inside the engine head and the cylinder block.

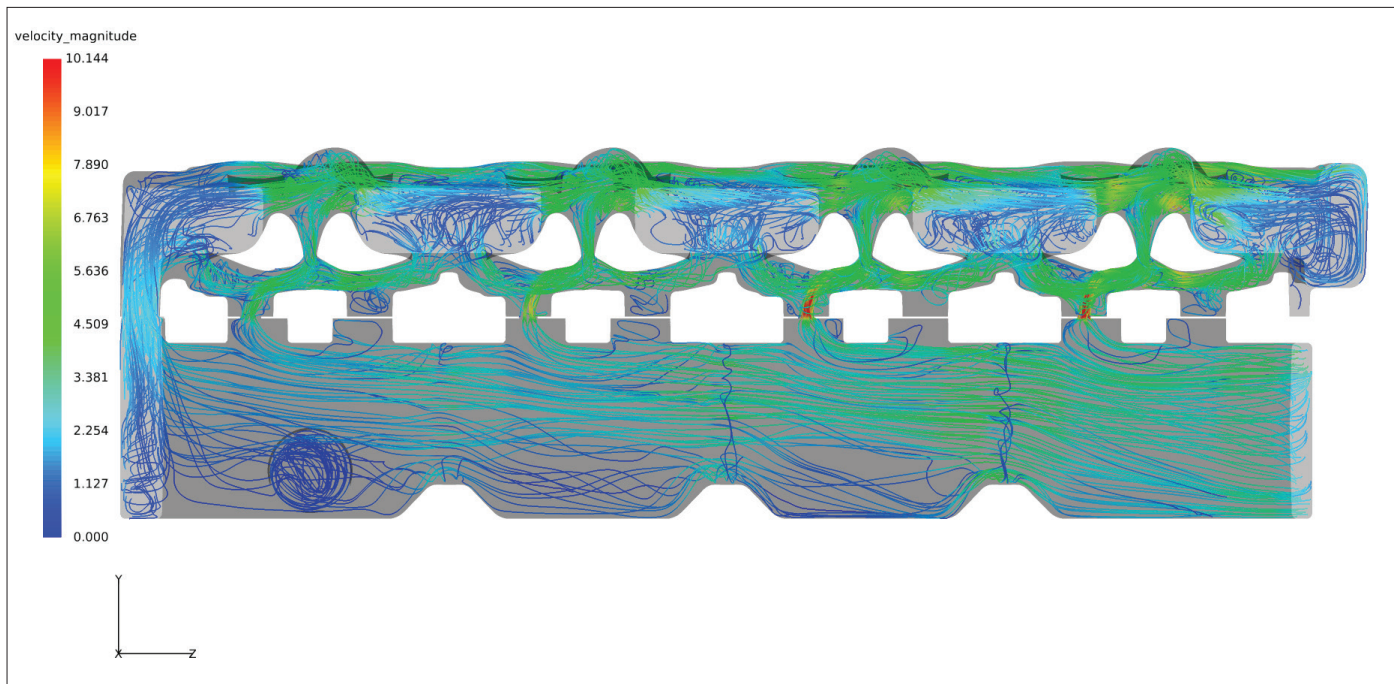
At first, Prodrive adopted a standard routine in terms of defeaturing the model,



V8 engine cylinderhead



V8 engine waterjacket



Waterjet velocity streamline contour plot

generating a surface mesh and defining the simulation parameters. However, this process was automated for the second run onwards, generating a streamlined workflow. Meaning that, after a quick defeaturing process, the simulation can be loaded onto the solver in a matter of minutes.

At the current stage, the limiting factor for Prodrive's simulation capabilities is computer hardware. This means that Altair's token licensing system plays an important role in maximising all of Prodrive's processing power, as the CAE Engineers can fully utilise Hyperworks software suite as necessary, without dealing with increased license costs.

These features were very important to fulfil Prodrive's requirements for a CAE package, as it enables the engineers to better manage their computational resources and workload.

Robustness and Reliability

The main feature observed in this approach was that, once the procedure was adhered to, every step ran smoothly and both pre-processing and post processing were accomplished in a short period of time.

Most importantly, all the elements of the results were automatically standardised for all candidate models, outlining the robustness of the AcuSolve software package. The Automation process made the analysis of a new geometry user friendly and easy to be accomplished.

AcuSolve's Post processing software, AcuFieldView made scrutinising the results an easy and straightforward process, in which different characteristics of the flow were isolated and analysed in detail. An example of this was being able to isolate flow within certain channels and then resolve its origins, destinations and any areas of recirculation.

AcuSolve's proven accuracy means Prodrive can save considerable time and expenses of laboratory testing and understand its designs to a level that wouldn't be possible without CFD tools.

Prodrive's Senior CAE Engineer Jonathan Culwick said "Having used Altair's HyperWorks suite for several years, I was aware of how powerful and easy to use it is. But when we decided to bring CFD capability in-house, I was concerned about the challenge of switching to AcuSolve

from outsourcing. However, AcuSolve's robustness and Altair's customer support made the process quick and painless, which enabled us to make the leap and achieve a level of analysis that really enhanced our problem solving and decision making ability."

Taking it a Step Further

The current simulation model is able to produce results that enable Prodrive's Engine development group to improve and further develop current products. However, it is their goal to quickly enhance this model by fully utilising other capabilities within Altair's Hyperworks Suite, such as:

- Conjugate Heat Transfer analysis – enable Prodrive to better quantify any improvement in terms of heat management.
- Further Post Processing Automation – Automating the image capture procedure and report generation to further streamline the workflow.

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Performance Simulation Technology

HyperWorks is an enterprise simulation solution for rapid design exploration and decision-making. As one of the most comprehensive, open-architecture CAE solutions in the industry, HyperWorks includes best-in-class modeling, analysis, visualization and data management solutions for linear, nonlinear, structural optimization, fluid-structure interaction, and multi-body dynamics applications.

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