



Using composites design simulation and virtual crash testing, Courage Competition increases its momentum towards a victory at the Le Mans 24-hour race

THE CHALLENGE

- Meet new stringent car racing regulations
- Optimize tuning and engineering time on track
- Quickly evaluate the most profitable solutions for limited edition manufacturing

THE STORY

“Using PAM-CRASH, we have successfully validated the results of a frontal crash on the survival body as well as other homologating crash tests on composite material structures. SYSPLY helped us produce a composite structure 25% lighter and almost twice as stiff as the previous one. Virtual crash-tests and the simulation of composite part design are now fully integrated within the development process of any new family of cars, in order to reduce the number of prototypes by one third”

Yves Courage, Courage Competition President and founder.

THE BENEFITS

- Cost savings by reaching the expected performance with the first real prototype: reach the target on the first shot
- Evaluation of multiple virtual prototypes within a 6-month time-to-market
- Management of components fatigue

Courage Competition is an independent French racing car manufacturer based in Le Mans. Since its first participation in the Le Mans 24-hour race in 1981, Courage Competition has been attending most endurance races worldwide. Courage Competition has delivered several high performing prototypes to an ever-increasing customer base.

TEAMING FOR COMPETITIVENESS

Courage Competition has as a permanent strategic objective to control the car's development from initial design to production. The company manufactures half of the composite body parts in its Le Mans workshops. In this respect, the independent French car manufacturer has deployed the most promising technologies to carry out development tasks while being ready to face new championship challenges.

A few years ago, Courage Competition initiated the CATIA V5 CAD/CAM solution in partnership with HP. After implementing this solution, Courage Competition is now focusing on both crash-tests and composite material structure design. The company intends to reduce the number of expensive physical prototype trials by using ESI Group's simulation solutions: PAM-CRASH for virtual crash test and SYSPLY for composite design simulation. In 2003, again in collaboration with HP, the first phase consisted of validating technical parameters by accurately reproducing real, measured data.

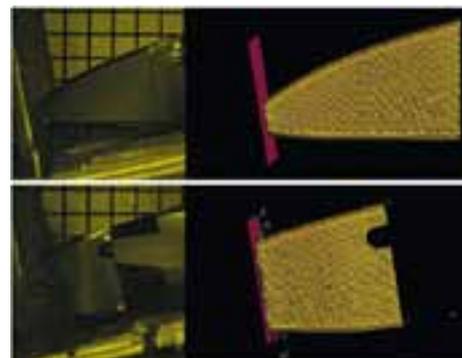
“Up to now, using PAM-CRASH, we have successfully validated the results of a frontal crash on the survival body as well as other homologating crash tests on composite materials structures” says Yves Courage, Courage Competition President and founder. “The design of the C65 prototype flat bottom also stands as a significant result; using SYSPLY we have produced a composite structure 25% lighter and almost twice as stiff as the previous one. The virtual



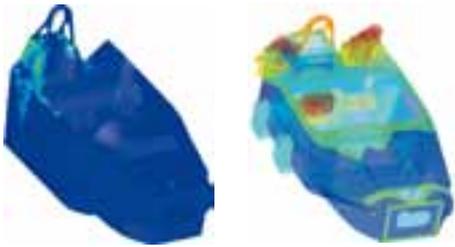
simulation of crash-tests and composite part design are now fully integrated within the development process of any new family of cars, in order to reduce the number of prototypes by one third” adds Yves Courage.

SIMULATION-BASED DESIGN BRINGS COURAGE COMPETITION TO THE FOREFRONT OF SAFETY REGULATIONS COMPLIANCE

The Courage C65 body has undergone several endurance racing homologating tests as specified by ACO (Automobile Club de l'Ouest), the most famous automobile club in France and also founder and organizer of the Le Mans 24-hour race.



PAM-CRASH validation of the C60 frontal crash (total mass: 1,000 kg, initial speed: 14 m/s, difference between experiments and simulation: less than 5%)

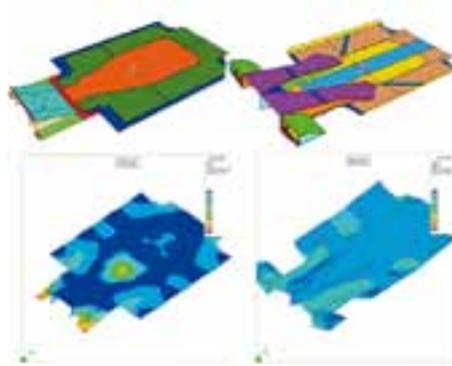


SYSPLY analysis of the C65 cockpit for the homologating test. Model with 41801 elements to study displacements, materials orientation, loads and pressure on the roll bar.

The tests consist of meeting a set criteria with a minimal weight. "The frontal crash and the analysis of loads and pressures on the roll bar have been shown to correspond with experimental measurements," explains Nicolas Perrin, race engineer responsible for Research & Development and FEM Analysis within Courage Competition. "SYSPLY allows the user to quickly identify areas where he can save weight and increase stiffness, which brings a competitive advantage in the design of future chassis." SYSPLY also helps optimize the shape, the alignment and the placing of carbon fabric, which accounts for more than

80% of the weight of a Courage prototype. Carbon is mainly used within the body, the chassis, the aerofoil or the undertray. A direct link with CAD enables several geometries to be imported from Catia for further design analyses using SYSPLY. During the designing sequence, SYSPLY assists the user in choosing the necessary number of layers, the alignment of fibers and the draping sequences.

All of this means considerable time and cost savings.



SYSPLY optimization of the C65 flat bottom

Future work will be directed towards the simulation of lateral crash to ensure an increased protection of the driver by also integrating fracture and fatigue.

In 2004, Courage Competition was the first and only competitor who launched their C65 racing cars, meeting new regulation and security rules of LMP2 prototype category.

The team is still looking to expand its technological leadership and innovation capacity through virtual simulation. The results obtained are quite significant and allow Courage Competition to consider a broadest customer base in Europe and the USA with the rapid acceptance of its commercial product in the LMP2 category. This credit will leverage the company's assets and provide the means to compete for the top endurance category, the LMP1 prototype, and win Le Mans 24-hour race!

To find out more about ESI's Composites Simulation Suite, including SYSPLY, visit: www.esi-group.com/composites

ESI AND HP ALLIANCE

ESI and HP: a partnership which responds to the new industrial challenges. The HP customers of the industrial manufacturing sector are more and more demanding regarding the power, the accuracy and the speed of the simulation tools. HP has always been involved in the supply of hardware with an impressive price performance ratio and works closely together with ESI to optimize the operation for End-to-End Virtual Prototyping software solutions over the new HP technologies. But the cooperation does not stop there: HP and ESI pursue their collaborative efforts on new processor architectures such as 64 bit based systems. In that way, ESI and HP customers benefit from all the advantages at early stages of the new product line.

ABOUT ESI GROUP

ESI is a pioneer and a world-leading provider in virtual prototyping that take into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on performance. ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping, thus eliminating the need for physical prototypes during product development. The company employs over 750 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit www.esi-group.com.



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