



BALANCING PERFORMANCE AND SAFETY

ALTAIR® HYPERMESH® HELPS STARD OPTIMIZE MOTORSPORT SPACE FRAME DESIGN

About the Customer

STARD is a pioneer in high-performance electric vehicles (EVs) and powertrain systems. STARD is based in Vienna, Austria, and forms an integral part of Stohl Group GmbH. For over 20 years, Stohl Group has been a global trailblazer in motorsports. As the group's advanced research and development (R&D) division, STARD manages an array of in-house activities, including vehicle development for motorsports and high-performance automotive applications. Its expertise spans high-performance high-voltage (HV) battery systems, motors, inverters, transmissions, electric architecture, and software development. By leveraging cutting-edge technology, STARD pushes the boundaries of innovation in the automotive and motorsports sectors.

Their Challenge

In modern race car design, safety is paramount; throughout professional racing, governing bodies set and enforce stringent safety guidelines. However, these requirements frequently conflict with performance goals. Enhancing safety typically involves adding material, thus increasing mass and hindering performance. Enhancing safety also usually requires multiple revisions and iterations, which increases development time. Without advanced tools like finite element analysis (FEA) and efficient optimization solutions, meeting these conflicting objectives can be time consuming and labor intensive.

STARD's main challenge was to enhance the design of a space frame of an electric race car to meet performance demands and evolving safety regulations. A space frame is a structural frame used to support the body and components of a vehicle. Cars with space frames are popular in racing since the frames' lightweight design improves speed and acceleration.



By integrating HyperMesh into our design process, we reduced space frame weight by 20% while exceeding stiffness and safety benchmarks. This streamlined workflow not only saved us time and costs, it also ensured we remain at the forefront of innovation in motorsport engineering.

Philipp Thonet, Chief Technology Officer, STARD (part of Stohl Group GmbH)



Try HyperMesh Today:
[Download Now](#)

The space frame design and testing process had to align with stringent performance criteria, including multiple variations of rollover and resilience tests. In each test, the space frame must withstand forces without failing or exceeding specified deflection limits. To address these challenges and optimize the space frame's stiffness and performance, STARD leveraged Altair® HyperMesh®.

Our Solution

Aiming to harmonize performance and safety within the space frame design process, STARD turned to HyperMesh's unparalleled FEA capabilities. The initiative began with an unoptimized CAD model of a space frame from a previous vehicle, which STARD simplified into a one-dimensional representation. This model served as the team's starting point.

The STARD team first enhanced the structure by adding material to high-stress areas, addressing weak points. This prevented potential failures and improved torsional stiffness, a key performance metric. They then applied optimization techniques to more effectively distribute material across the frame. This strengthened areas that needed reinforcement while eliminating unnecessary mass.

Subsequently, STARD refined the space frame's tube diameters. This minimized weight while preserving structural integrity. The team also employed high-fidelity modeling techniques in critical areas, particularly those involved in the static load tests. Material-specific parameters were incorporated to accurately simulate plastic deformation.

Throughout, HyperMesh supported a multi-step design exploration process, enabling the use of reusable models across scenarios. This reduced the need for extensive physical testing, allowing the team to evaluate multiple performance aspects and streamline validation cycles – accelerating the design process while meeting stringent safety standards.

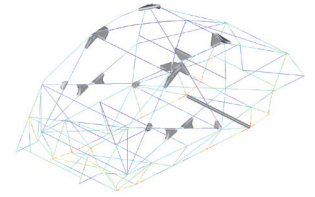
Results

Overall, HyperMesh enhanced STARD's engineering process and delivered results that surpassed expectations. With HyperMesh, STARD reduced the rally car's space frame weight by 20% compared to the baseline model and enhanced performance while ensuring safety. And despite its lower weight, the new design was stiffer, which improved the car's structural integrity while increasing its handling and durability.

The streamlined design process also shortened development timelines, reducing the number of physical tests required and creating substantial cost savings. This quickened iteration and equipped STARD with a more agile approach to addressing performance and regulatory requirements.

Overall, HyperMesh's advanced capabilities transformed STARD's design methodology, enabling the efficient exploration of multiple design possibilities while ensuring confidence in the final product. By embracing this innovative approach, STARD successfully balanced safety and performance in their latest rally car.

To learn more, please visit altair.com/hypermesh.



TOP: Stress distribution in the frame (simplified model).
BOTTOM: HyperMesh streamlined the space frame's final design, exceeding initial targets.

