#KKraftingPolymerPossibilities

CASE STUDY

Track-Tested Engineering: Advancing EPP Cores for Formula Racing

Introduction

Veloce Racing India is a student engineering team from Vishwakarma Institute of Technology (VIT), Pune, that designs and builds formula-style race cars for national competitions such as SUPRA SAE India and Formula Bharat. These platforms demand innovation, precision engineering and strict adherence to safety and performance regulations.

During the development of their latest race car, the team identified excessive vehicle weight particularly in the aerodynamic system as a key performance bottleneck. To address this challenge, they approached K. K. Nag Private Limited for technical support and advanced material expertise.

This collaboration led to a major milestone with Veloce Racing India successfully integrating Expanded Polypropylene (EPP) foam into a competitive race car aerodynamic structure.

Background

Aerodynamic components in student formula competitions must comply with stringent structural rules. Each aerodynamic device must withstand a 20 kg static load while limiting deflection to no more than 10 mm. These requirements demand a structurally reinforced internal core rather than hollow constructions.

Initially, the aerodynamic package weighed approximately 20 kg. During early development and prototyping phases, Expanded Polystyrene (EPS) supplied by K. K. Nag was utilised as the core material.

The EPS-based optimisation reduced the aerodynamic weight by approximately 2 kg from ~20 kg to ~18 kg while maintaining compliance with structural standards.

While this represented progress, further optimisation was necessary to significantly enhance overall vehicle efficiency and dynamic performance.

The objective for the new season was clear – achieve substantial aerodynamic weight reduction while maintaining stiffness, durability and full regulatory compliance

Key Challenges

- Achieving major weight reduction while meeting 20 kg load and 10 mm deflection criteria.
- Maintaining structural stiffness under competitive racing conditions.
- Improving composite consistency and internal load distribution.
- Minimising resin absorption during carbon fibre lamination.
- Implementing an advanced material solution within a tightly regulated environment.

K. K. Nag's Technical Approach

Leveraging its expertise in advanced polymer engineering, K. K. Nag Private Limited proposed EPP as a high-performance composite core material and worked closely with the team throughout development.

Support extended beyond material supply and included:

- Application-specific material selection guidance.
- Recommendations on optimal core density and structural layout.
- Insights into EPP's energy absorption and resilience under load.
- Guidance on integration with aluminium reinforcements and carbon fibre spars.
- Consultation during lamination and static load validation testing.

The final aerodynamic construction incorporated:

- Solid EPP core precision-shaped to aerodynamic profiles.
- Laser-cut aluminium reinforcement elements.
- Carbon fibre spar for structural rigidity.
- Carbon fibre skins applied through controlled hand lay-up processes.

This engineered configuration delivered high stiffness and structural reliability while achieving aggressive weight optimisation targets.

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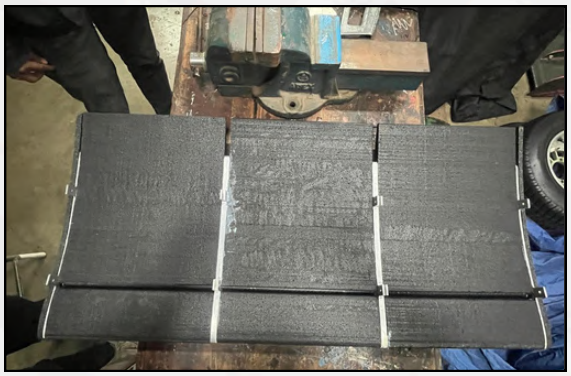
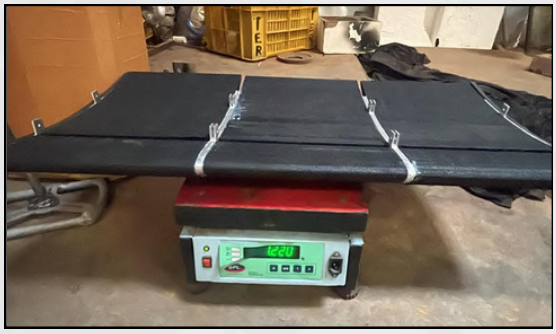
EPP Aerodynamic Assembly

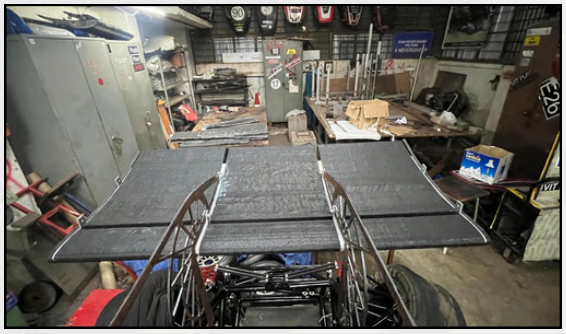
EPP Core with Carbon Fibre Skin



EPP Wing Panel and Aluminium Spars



EPP Aero Package – Weight Validation



EPP Front Wing Assembly

Laser-Cut Aluminium Reinforcements

EPP Rear Wing Structure

EPP Aero Integration on Car Chassis

EPP Foam Core – Surface Detail

Results

Support extended beyond material supply and included:

- Aerodynamic package weight reduced from ~20 kg to under 10 kg.
- Successful compliance with 20 kg static load and 10 mm deflection regulations.
- Improved stiffness-to-weight ratio.
- Enhanced structural predictability under load.
- Better control over composite layup with optimised resin usage.
- Improved acceleration, handling precision and overall vehicle dynamics.

The improved aerodynamic efficiency played a decisive role in the team's competitive success. Veloce Racing India won the Formula Bharat competition, demonstrating the effectiveness of advanced material integration and precision engineering.

Conclusion

This project demonstrates how targeted material innovation can unlock significant performance improvements, even within tightly regulated environments. By enabling the first-time use of EPP in a student formula race car, K. K. Nag Private Limited supported a breakthrough that delivered measurable gains in weight reduction, efficiency and durability.

The collaboration stands as a strong example of how industry expertise can empower student innovation, paving the way for future advancements in lightweight mobility and polymer applications.