

New Advances in Driver Safety: Head Restraints, Belts, Collars & Head Surrounds

Driver safety continues to evolve at an incredible pace, and one of the industry's leading innovators recently shared the latest developments during an EPARTRADE Race Industry Now webinar.

Hosted by Brad Gillie of SiriusXM Ch. 90, Late Shift, the presentation featured Trevor Ashline, President & Owner of Engineered Safety Systems (ESS), whose decades of work have helped shape many of the driver protection technologies used throughout motorsports today. Rather than focusing on a single product, Ashline demonstrated how modern safety depends on every component of the occupant restraint system working together as an integrated package.

Looking Beyond Individual Components

A recurring message throughout the webinar was that no single safety device protects a driver by itself.

According to Ashline, optimal crash protection comes from designing the entire restraint system—including the seat, seat belts, head restraint, helmet, neck collar, head surrounds, mounting hardware and energy-absorbing foam—to function together during an impact.

"The restraint system is only as good as its weakest component," Ashline explained while discussing how crash forces must be distributed across the strongest areas of the body while maximizing the amount of time available to decelerate the occupant.

This systems-engineering philosophy has become increasingly important as race cars continue to become faster while driver compartments become more rigid.

Modern Head Surrounds Continue to Evolve

One of the major discussion points centered around head surround technology.

Ashline explained that today's head surrounds are dramatically different from those introduced nearly two decades ago. Improvements in geometry, energy absorption and driver containment have significantly increased protection in both frontal and lateral impacts.

Drawing from his experience working with professional race teams—including projects dating back to the Eric Medlen safety initiative and more recent work with NHRA teams following John Force's accident—Ashline discussed how larger, properly positioned head surrounds can dramatically improve protection.

One common mistake he sees at the grassroots level is undersized head surrounds.

If the head surround is shorter than the helmet itself, it cannot effectively manage lateral movement during an impact. Maximizing contact area between the helmet and the energy-absorbing structure allows crash loads to be spread over a much larger surface, reducing peak forces on the driver.

Maximizing Energy Management

Throughout the presentation, Ashline emphasized that good restraint design is fundamentally about energy management.

Several key engineering principles were highlighted:

- Increase occupant ride-down time to reduce peak G-forces.
- Engage the restraint system as early as possible during the crash sequence.
- Spread impact loads over the largest possible area.
- Transfer forces into the body's strongest skeletal structures rather than soft tissue.

He demonstrated how proper foam selection and layered energy-absorbing materials play a major role in controlling deceleration rates.

Different foam densities perform differently depending on impact severity, making foam selection and placement every bit as important as structural design.

Seat Belt Design Is Far More Than Webbing

ESS manufactures a complete range of SFI-certified harness systems ranging from grassroots racing applications to professional motorsports.

Ashline spent considerable time discussing proper belt geometry, mounting angles and hardware selection.

While modern webbing materials feature extremely low elongation and high tensile strength, installation remains equally important.

Incorrect mounting angles or poorly designed anchor locations can significantly reduce the effectiveness of even the highest-quality harnesses.

He also reviewed newer seven-point belt configurations becoming more common in drag racing and explained why anti-submarine belt positioning, proper seat interface and keeping the webbing flat against the seat are critical to achieving the intended performance during severe impacts.

New Generation Head & Neck Restraints

Another highlight of the webinar was ESS's newest head restraint system.

The latest design incorporates a single-tether configuration that attaches using the FIA 8859 helmet mounting location found on most modern motorsport helmets.

Ashline explained that the simplified tether arrangement improves usability while maintaining compatibility with multiple attachment systems, including post anchors, helmet quick releases and snap shackles.

The restraint itself has also been optimized around FIA dimensional requirements.

By minimizing unnecessary bulk while maximizing the structural areas responsible for managing crash loads, ESS has reduced weight while improving overall performance.

Additional refinements have also made the device lighter, stronger and easier for racers to use.

Driver Comfort Improves Safety

Ashline noted that comfort should never be overlooked when designing safety equipment.

A restraint system that fits properly allows drivers to maintain better control of the vehicle while reducing fatigue during long races.

Features such as properly fitted neck collars, optimized harness geometry and improved ergonomic design help drivers remain secure without unnecessarily restricting movement.

This balance between mobility and restraint has become a major focus of modern safety engineering.

Safety Education Remains Essential

One of the more practical sections of the webinar focused on educating racers.

Ashline discussed several examples where equipment was technically installed but unable to perform as intended because of misunderstandings regarding mounting practices, head surround sizing or padding placement.

He used junior dragsters as one example, explaining how roll bar padding should protect areas the driver's head may contact during an actual crash—not simply areas reachable while sitting stationary in the cockpit.

These real-world installation details often determine whether safety equipment performs as engineers intended.

Continuous Innovation Drives Better Protection

As vehicle performance continues to advance across every form of motorsports, safety systems must evolve alongside it.

Through continued development of head restraints, seat belt systems, neck collars and head surrounds, Engineered Safety Systems remains focused on improving how crash forces are managed before they ever reach the driver.

Ashline's presentation reinforced an important principle shared throughout the motorsports safety community: driver protection is never finished. Every improvement in materials, geometry, testing and integration represents another opportunity to reduce injury and improve survivability.

For race teams, builders and safety professionals, the webinar provided an in-depth look at the engineering principles that continue to shape the next generation of motorsports occupant protection systems.

For more information, [watch the full webinar here.](#)