

Safety Spotlight: The Halo

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The Halo was originally a controversial addition to the build of a Formula 1 car, but now we can't imagine life without it.

Author's note: the following article contains links to footage of high impact vehicular crashes that some readers may find disturbing. Readers should be advised that any link marked with an asterisk (*) should be viewed at their own discretion.

History

Accidents are no stranger to the world of motorsport. Most of them are scary, but survivable, however some drivers have not been so lucky and have unfortunately lost their lives, such as Formula 2 driver [Henry Surtees](#)* and Formula 1 legend [Ayrton Senna](#)*. The need for increased head protection was not brought to major attention until [Jules Bianchi's horrific crash](#)* at the Japanese Grand Prix in October of 2014, from which he ultimately passed away in July of the following year. Bianchi suffered from serious head and neck injuries due to aquaplaning on the rain-soaked track, sending his Marussia into a crane that had been dispatched to retrieve another crashed car.

The original idea of the Halo was presented by Mercedes in 2015, but the actual device wasn't implemented until 2018, and ever since then it's been a mandatory piece of an F1 car's anatomy. With racing only getting faster as the sport develops, many called for more safety precautions to be taken in order to protect drivers, especially their heads, which are the only part of their bodies to not be completely surrounded by the car.

This brought up [aesthetic concerns](#), such as taking away from the open cockpits that had always been a staple in single seater racing, but that was a sacrifice they were willing to make for the safety of the drivers. Some were also worried about the center post that connects to the front of the car, with many fearing it could possibly be a distraction and block the driver's view. Fortunately, since they spend much of their time looking at approaching corners and apexes, rather than straight ahead, it's hardly a minor inconvenience. An aeroscreen (as seen in [Indycar](#)) was also considered as an option, but it had its own [disadvantages](#) since it was heavier and was more at risk for reflective disturbances.

How It Works

The [Halo itself](#) is made from 7 kilograms of sculpted titanium, and is so strong that it can withstand the weight of a London double decker bus directly on top of it. It's a standard part required by all teams, and the core is the same for everyone, however they can individually play around with aerodynamic features that make it best suited for their cars. For example, they have to make sure the wake from the Halo doesn't damage the behavior of the rear wing or interrupt the engine performance.

This is the first generation of safety that goes up, over, and around the driver's head, and is a key part of the survival cell of the car. This survival cell, also called [The Tub](#), is where the driver sits and is made of thin, but rigid, carbon with [Zylon](#) anti-intrusion panels to protect the driver from penetration from various impacts. Everything around this structure is designed to break off and leave the cockpit, halo, and roll hoop intact.

By FIA regulations, the cockpit roll hoop is known as the primary roll structure, and the Halo is known as the secondary roll structure. If a line were to be drawn between the V-point of the Halo and the top of the cockpit roll hoop, the top of the driver's head must be 75 millimeters below that line; this way, if the car flips upside down, the driver's helmet doesn't make contact with the ground. For a more visual example, click [here](#).

Saved Lives

Flipped cars are not a new occurrence in Formula 1, but one of the most recent (and arguably most dramatic) instances has to be Zhou Guanyu's [opening lap crash](#)* in Silverstone in 2022. In a series of unfortunate events, the front right tire of Pierre Gasly's Alpha Tauri clipped the rear left tire of George Russell's Williams, knocking Russell off balance and sending him directly into Zhou. The impact of this crash flipped Zhou's Alfa Romeo, sending it skidding and sparking across the track before sliding along the gravel and being thrown into the catch fencing, fortunately protecting fans as well as bringing his car to a halt and preventing further damage. Thankfully, the driver escaped unscathed.

Another extreme accident was that of [Romain Grosjean](#)* during the 2020 Bahrain Grand Prix. After cutting across the track and making contact with Daniil Kvyat, Grosjean's Haas was sent directly into the metal barriers, tearing the car in half and resulting in a massive fireball. The Halo arguably worked overtime in this instance by keeping him from being struck, or even decapitated, by the guardrail. To see an in depth analysis on the series of events that caused this terrible accident, click [here](#), and to see Romain himself describe how it felt to face death and how he escaped, click [here](#).

Since the Halo's introduction, many other drivers have been saved, including (but not limited to) [Charles Leclerc](#) at the 2018 Belgian Grand Prix after Fernando Alonso's McLaren flew directly over his head, and [Lewis Hamilton](#) at the 2021 Italian Grand Prix when max Verstappen's Red Bull literally landed on top of him.

Thankfully, Zhou, Grosjean, Leclerc, and Hamilton are still with us and can personally express their gratitude for the feat of engineering that is the Halo. Had the device been implemented earlier on, perhaps it could have saved Surtees, Senna, and Bianchi as well.