

## Accident Analysis

The investigation focused on the two cars that were involved in the accident – the #8 driven by Romain Grosjean and the #26 Scuderia Alpha Tauri car driven by Russia's Daniil Kvyat, noting that several other cars had a circumstantial but non-consequential effect on the initiation of the accident sequence.

During the opening lap of the Bahrain GP, Romain Grosjean's car was travelling at 241 km/h when he lost control on the exit of Turn 3 following contact between his right rear wheel and Daniil Kvyat's left front wheel when attempting to pass from the left to right-hand side of the track.

The car-to-car contact lifted the rear of Romain Grosjean's car, forcing it to yaw to the right and placing it on an out-of-control trajectory into the run-off area on the inside of the circuit at the exit of Turn 3. Daniil Kvyat also altered trajectory and entered the same run-off area but was able to re-join the track shortly after without further contact.

Romain Grosjean's car impacted the triple guardrail barrier behind the run-off area at 192 km/h and at an angle of 29 degrees, with an estimated yaw of 22 degrees to the direction of travel and a resultant peak force equivalent to 67g. Following the failure of the middle rail of the barrier and significant deformation of the upper and lower rails, the survival cell was able to pierce the barrier and came to rest behind the barrier, constrained by the primary roll structure against the upper rail of the barrier.

The car suffered extensive damage during the impact including separation of the power train assembly from the survival cell. The fuel tank inspection hatch on the left-hand side of the chassis was dislodged and the engine fuel supply connection was torn from the fuel tank "safety bladder"; both providing primary paths for the escape of fuel from the tank.

The driver safety equipment including helmet, HANS and safety harness as well as the survival cell, seat, headrest and Halo frontal cockpit protection performed according to their specifications in protecting the driver's survival space and managing the forces applied to the driver during the impact.

The high voltage Energy Recovery System (ERS) battery was significantly damaged, with some parts of the ERS battery assembly remaining with the powertrain and others remaining attached to the survival cell.

Fire was ignited during the final moments of the barrier impact, starting from the rear of the survival cell and progressing forwards towards the driver as the fire grew.

The resting position of the survival cell, relative to the upper rail of the barrier significantly restricted the path for driver egress. Due to damage to the survival cell and a number of components within the cockpit environment, Romain Grosjean's left foot was initially trapped as the car came to rest. The driver was able to free his foot by withdrawing it from his racing boot leaving the boot in the entrapped position in the car and then moved both the dislodged headrest and steering wheel to egress the car.

The race was red flagged approximately 5.5 seconds following Romain Grosjean's impact with the barrier.

## Medical and Rescue

A comprehensive medical and rescue response to this incident was immediately initiated. The FIA Medical Car arrived within 11 seconds of the incident, a time achieved partly due to the fact a 'short cut' was taken to avoid turn 1, demonstrating both local circuit knowledge and pre-planning.

The arrival of the Medical Car carrying the FIA F1 Medical Rescue Coordinator Dr Ian Roberts, FIA F1 Medical Car Driver Alan van der Merwe and a local doctor, provided immediate assistance with each performing a pre-determined role.

Ian Roberts went immediately to the scene of the incident and instructed a marshal to operate the dry powder extinguisher around the cockpit where he identified Romain Grosjean as trying to make his egress. Alan Van der Merwe retrieved a fire extinguisher from the rear of the FIA Medical Car whilst the local doctor prepared the trauma bag.

Romain Grosjean was able to egress unaided and was out of car after 27 seconds.

Romain Grosjean suffered burns to the back sides of both hands. Following initial examination by the FIA Medical Car personnel he was transported by ambulance to the circuit Medical Centre for evaluation. He was subsequently transported by helicopter to the Bahrain Defence Force Hospital for further assessment and treatment. He was discharged from hospital after three days, on December 2, 2020.

FIA President Jean Todt said: *"Important learnings have been drawn from these investigations that will drive our continuous mission to improve safety in Formula 1 and global motor sport. The enduring commitment of the FIA, particularly the Safety Department, on reducing risks associated with motor sport enabled Romain Grosjean to maintain consciousness and survive an accident of this magnitude. Safety is and will remain FIA's top priority."*

FIA Safety Director Adam Baker said: *"Incidents involving fire of this scale are thankfully rare, so it is very important to learn what we can, including the interaction with the high voltage system. The efforts of those involved were heroic and have quite rightly been the subject of much praise. Following the approval of our findings by the World Motor Sport Council, we will integrate the actions into the ongoing work."*

## 2021 FIA Circuit Racing Safety Initiatives

In 2020, the FIA Safety Department conducted investigations into 19 significant accidents related to circuit racing, supported by the ASN (National Sporting Authority) in each country.

In line with the FIA's commitment to continuous safety improvement and as a result of its pre-existing body of motor sport safety data, extensive expertise, ongoing research projects and the knowhow generated by motor sport incidents from around the world in recent decades, including these 19 accidents, the federation is undertaking work in the following areas:

### Vehicle

- Regulation of survival cell front geometry, plus additional load tests in that area
- Review of existing regulations regarding rear view mirrors
- Review of steering column mounting requirements
- Review of regulation and homologation requirements for headrest assembly
- Analysis of Power Unit mounting and mount failure modes
- Ongoing research project: Wheel Restraint Cables (tethers)

- Design review of safety fuel bladder installations in all FIA single seater categories
- Recommendations for safety fuel bladder installation best practice
- Update of the FIA Standard for safety fuel bladders
- Review of regulations for design of safety fuel bladder connections and inspection hatches
- Fuel homologation to include compatibility of bladder material and specific fuel  
Circuit
- Increased functionality for Circuit Safety Analysis Software (CSAS) including quantitative impact probability classification
- Review of existing circuit barrier opening installations
- Review of guidelines/process for circuit homologation and licence renewal  
Driver safety equipment
- Investigation into improvements to the gloves' Heat Transfer Index (HTI)
- Ongoing research project: Visor opening/locking mechanisms; project scope extended to include requirements to ensure that visor opening systems are operational after being exposed to fire
- Ongoing research project: Extinguisher system for open cockpit cars; project scope extended to include investigation of improved activation mechanisms  
Medical and Rescue
- Updates to Medical Intervention Vehicle equipment, including alternate extinguisher types
- Provide ASN guidance on post-fire decontamination
- Ongoing development of FIA firefighting training module for ASNs
- Ongoing development of FIA high voltage safety training module for ASNs
- Ongoing development of FIA Incident Command/Co-ordination training module for ASNs  
Additionally, the FIA Safety Department is also planning further research projects such as:
- Investigation of options for proximity warning systems and electronic visibility aids
- Research into retrofit and upgrade options to improve impact performance of existing guardrail barriers
- Research into novel barrier systems, effective across a wider range of impact conditions
- Research to assess current fire extinguishing media, firefighting equipment and personal protective equipment and assess new technologies