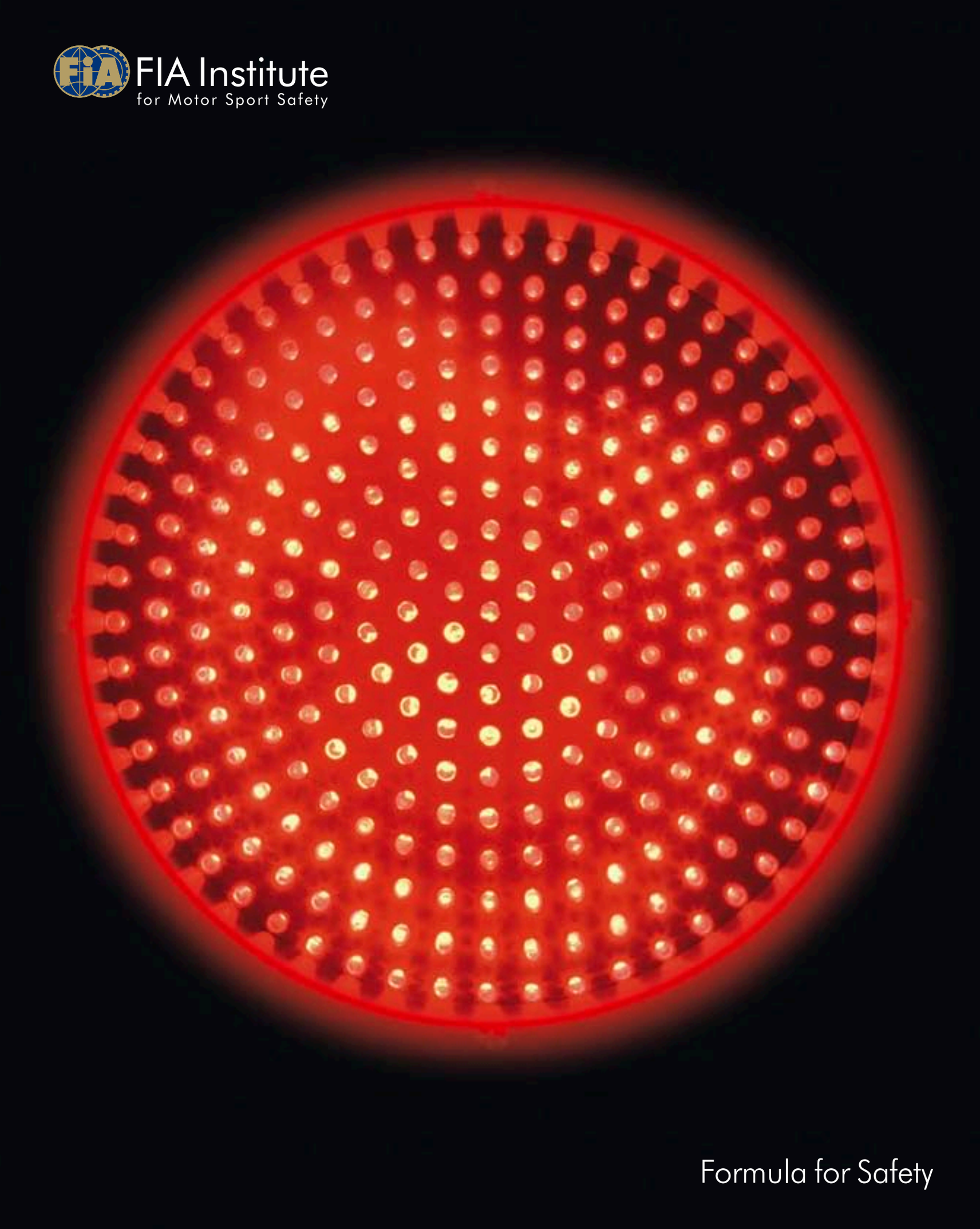
FIA Institute
for Motor Sport Safety



Formula for Safety

The FIA Institute improves the safety of motor sport through analysis, research, testing and development.

Front Cover: Pit lane exit stop light at the Autodromo Nazionale di Monza.

The Renault F1 Team during a pit stop at the 2005 French Grand Prix.

02 | Welcome

04 | Introduction

06 | What the Drivers Say About the FIA Institute

08 | About the FIA Institute and its Objectives

10 | Structure of the FIA Institute

Welcome
Professor Sid Watkins, FIA Institute President

1. FIA Institute President Professor Sid Watkins.

2. Helmet research for the FIA Institute young driver's crash helmet project.

3. Paul Ricard HTTT, the FIA Institute's first Centre of Excellence.

4. Charlie Whiting in the start tower at the 2005 Chinese Grand Prix, Shanghai.

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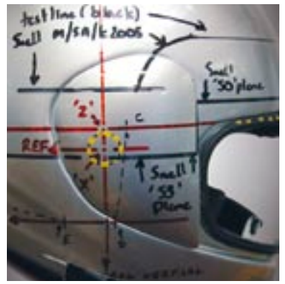

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I have spent most of my life working to improve motor sport safety and I can think of no greater honour than being elected as the first President of the FIA Institute.

Our aims at the FIA Institute are very clear, to encourage the rapid development of new and improved safety technologies, to facilitate ever higher standards of education and training and to campaign to raise awareness of safety issues amongst all of those involved in our sport.

It is the FIA Institute's commitment to rapid progress which is perhaps the most satisfying. In our first two years we have already commissioned more than 50 projects, the vast majority of which will have a very significant bearing on the way we go racing and rallying.

A project such as developing a new crash helmet specifically engineered for young drivers up to 16 years old has broken new ground and has done so in record time. After only 18 months, laboratory testing is already underway on a prototype and production on the final version is set to begin by the end of 2007.

Recognising and rewarding excellence in motor sport achievement is also fundamental to our approach.

Our Centre of Excellence programme is set to roll out across established and emerging motor sport markets worldwide and our close liaison with national sporting authorities as well as the key industry players will encourage new safety partnerships to flourish.

Our work has only just started but we could not have made a better beginning. With the help and support of all of those working and competing in international motor sport the FIA Institute will always strive to ensure that safety comes first.

Professor Sid Watkins, FIA Institute President

Introduction
Professor Gérard Saillant, FIA Institute Deputy President

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It is perhaps appropriate that the FIA Institute was inaugurated in Paris during the FIA's centenary celebrations. It demonstrated that whilst recognising motor sport's history and heritage the FIA was not only thinking of the past but also the future.

Ever since I was invited to become involved in its work, first as a Fellow and now as Deputy President, the FIA Institute has consistently echoed this forward thinking and dynamic vision.

Motor sport will always be a sport with an element of risk. Preventing accidents is not always possible but striving to minimise the consequences of an accident is fundamental to the FIA Institute's approach. Whether in terms of driver equipment, crash test standards, circuit infrastructure design or the training of officials, the FIA Institute is working to improve all of the elements which together create the system of safety in motor sport.

Medicine and sport have been the twin vocational passions which have defined my professional life. The opportunity to bring these two passions together in the important work of the FIA Institute is one that I greatly value.

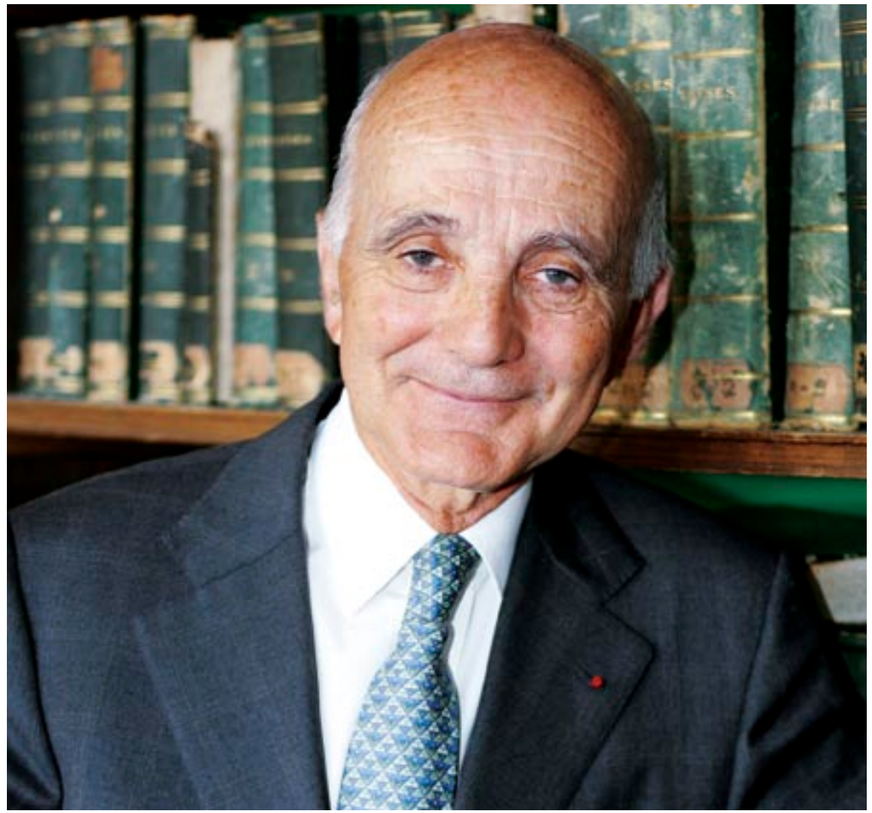
Professor Gérard Saillant, FIA Institute Deputy President

1. A member of the WilliamsF1 pit crew prepares for refuelling.

2. A member of the FIA Scrutineering team examines the F1 cars on the grid.

3. FIA Institute Deputy President Professor Gérard Saillant.

4. Medical equipment stored in the FIA Formula One Medical Car.



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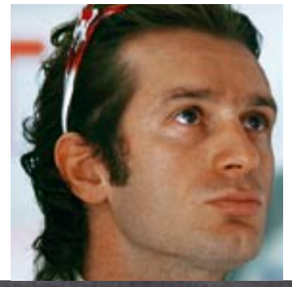
What the Drivers Say About the FIA Institute

Michael Schumacher
Formula One

"Safety in motor sport has improved hugely since my Formula One debut in 1991. But that does not mean we should stop aiming to raise the standard. There is always room for improvement and the FIA Institute's work is vital for the continual safety of all drivers."



Jarno Trulli
Formula One

"Safety is such an important aspect in motor sport. Without an organisation like the FIA Institute constantly pushing to develop safety we could not as drivers push as hard as we do on the track. Long may the FIA Institute continue to work for the safety of all of us."

Alex Wurz
Formula One

"It is good to know that there is an organisation out there devoted solely to improving motor sport safety. As a driver, it is especially important that work continues in this area to keep us free from injury and maintain the high standards of this great sport."

Sébastien Loeb
World Rally

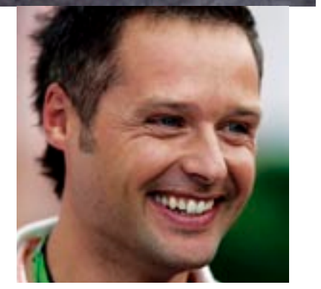
"The research projects undertaken by the manufacturers in conjunction with the FIA Institute give me a huge amount of confidence in the future safety of rallying. We all know that our sport isn't without danger but I really think that a lot of work has been done on the cars and on safety in general. Our cars are much stronger, we're now wearing the HANS device and the security in the stages is better. It is great to know that the FIA Institute is working hard to develop safety in these areas on our behalf."

Marcus Grönholm
World Rally

"Rallying is a special sport which demands a unique set of safety requirements. It is not just about the drivers either. Protecting the public is obviously of paramount importance to the sport's future while allowing them to enjoy the spectacle. So it is essential that the FIA Institute continues to work behind the scenes to make rallying as safe as possible for all of us."

Andy Priaulx
World Touring Car

"The FIA Institute's commitment to safety research is the evidence that the FIA is pro-active rather than reactive. It is not waiting to take measures after an accident; on the contrary it tries to foresee the problems and solve them before they happen."



About the FIA Institute and its Objectives

1. ACM marshals on duty during practice for Round 5 of the 2006 GP2 Series in Monte-Carlo, Monaco.

2. FIA Formula One Safety Car.

3. Protective high-grip glove.

4. Safety restraint system.

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History

The FIA Institute was established in October 2004 by the FIA and the FIA Foundation. It receives an annual grant from the FIA Foundation to fund research projects and other safety-led activities.

The FIA Foundation itself was formed with monies from the FIA, following the sale of the 100-year commercial rights to the FIA Formula One World Championship. As such, the income from Formula One has not only improved safety in motor sport but also has been used to help raise the standard of public road safety.

Objectives

The objective of the FIA Institute is to promote improvements in the safety of motor sport across all disciplines from junior championships to the top level race series and from closed car to open wheel racing. It does this in a number of ways:

- Promotes research, disseminates the results of research and provides information on the best safety procedures, practices and technologies that can be applied to motor sport safety. This research covers all aspects of motor sport safety including driver equipment, vehicle design, circuit design, spectator protection, rescue facilities, medical facilities and race control.

- Supports the training of officials, circuit and race personnel in safety procedures, practices and the use of equipment.

- Supports the protection of participants, officials and members of the public at international motor sport events.

- Monitors motor sport safety trends in order to identify research and regulation priorities.

- Manages non-regulatory safety activities such as research, training and medical control.

"The Institute is working to improve all of the elements which together create the system of safety in motor sport."

Professor Gérard Saillant, FIA Institute Deputy President

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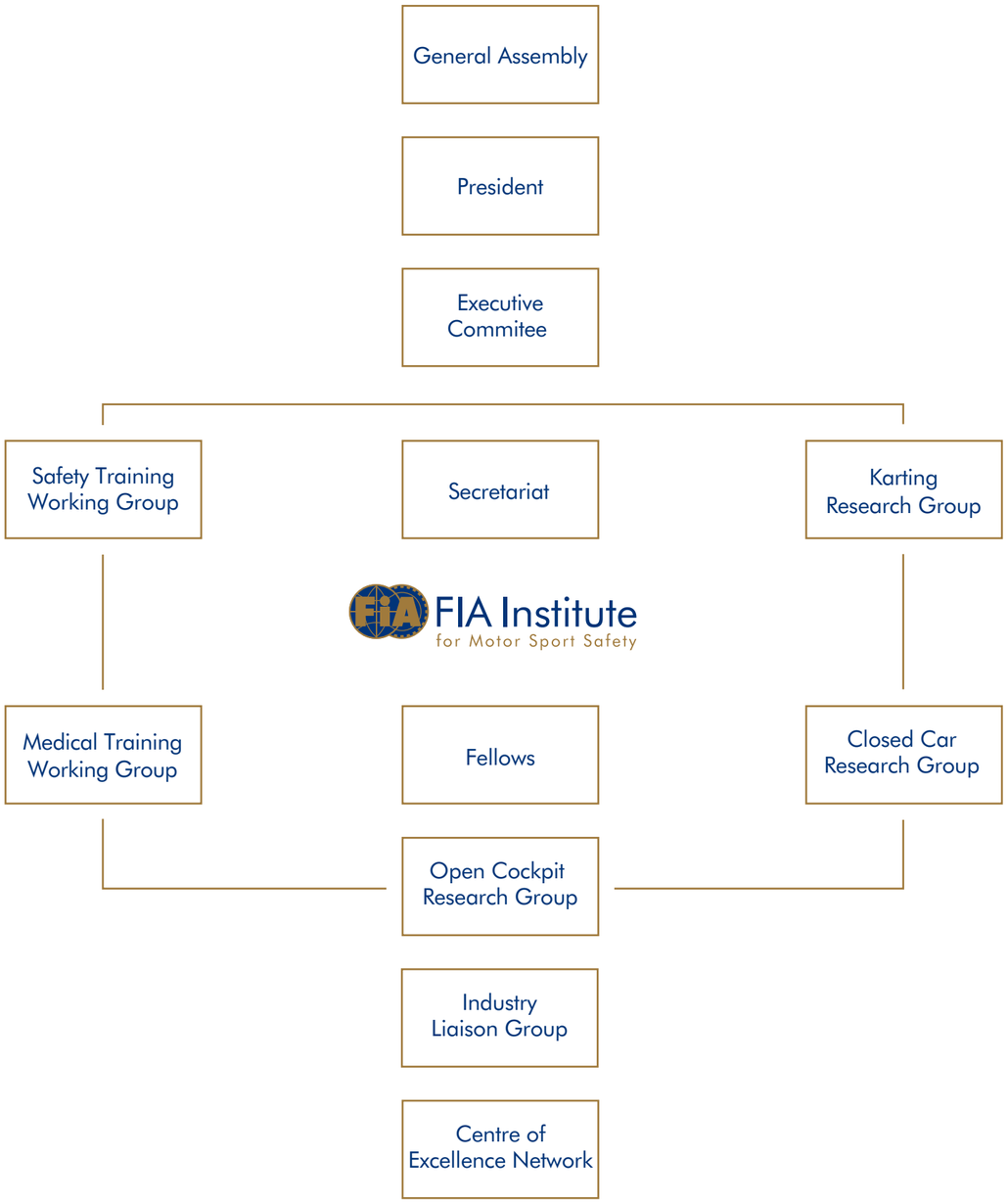
Structure of the FIA Institute



Fire marshal at the 2004 Monaco Grand Prix.

The Research and Working Groups cover every aspect of motor sport safety.

14 | Open Cockpit Research Group

17 | Safety Training Working Group

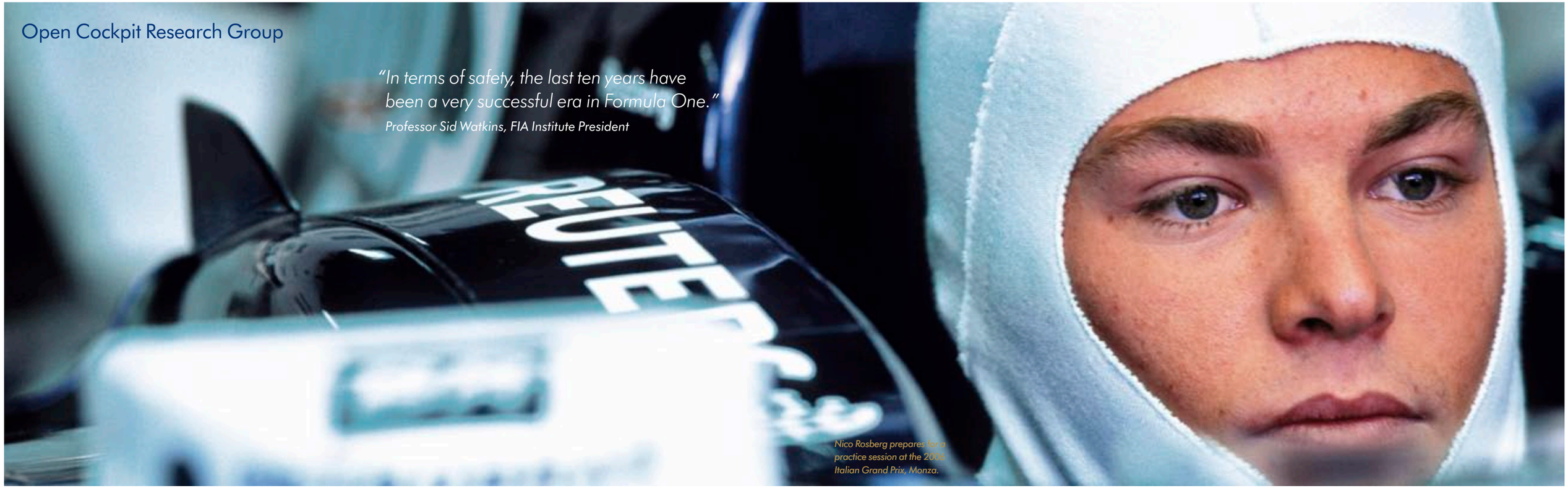
18 | Closed Car Research Group

21 | Medical Training Working Group

22 | Karting Research Group

24 | Industry Liaison Group

A Ferrari 430 GT2 at the 2006 FIA GT Proximus 24 Hours of Spa-Francorchamps, Belgium.



Nico Rosberg prepares for a practice session at the 2006 Italian Grand Prix, Monza.

It is no accident that safety in open wheel racing has improved hugely in the last decade. The FIA, and more recently the FIA Institute, have put a vast amount of research into improving motor sport safety and this work will continue to ensure that very high levels of safety are provided to drivers, race personnel and, of course, the fans.

The various groups that were formed to carry out this research began with the FIA Medical Commission in the early 1980s and have culminated in the formation of the Open Cockpit Research Group (OCRG), one of the three major research bodies managed by the FIA Institute.The OCRG directs principal research into safety issues relating to open cockpit racing cars, which is relevant to all open-wheel cars from Formula One and the Indy Racing League to entry level series such as Formula Ford.

The progress in open wheel racing has been dramatic. Spectators often stare in amazement when a driver walks away from a heavy crash in an open cockpit race car. This is no miracle but rather the embodiment of years of motor sport safety research and development carried out by the OCRG, its partners and its predecessors.

The OCRG recognises that no matter how much the injury statistics may improve, there is always room for progress. Much of its work is data driven, using the information taken from numerous similar racing incidents, both with and without injury, to define safety objectives and strategies. The modern era of safety was spawned in 1994, following the tragic deaths of F1 drivers Roland Ratzenberger and Ayrton Senna.

It was then that FIA president Max Mosley, already a major activist for safety, intensified his campaign to improve safety standards across all levels of motor sport.

At the time, Mosley called upon the help of Professor Sid Watkins MD, one of the world's top neurosurgeons, who had been working in Formula One since 1978, when Bernie Ecclestone, then boss of the Formula One Constructors Association, offered him the job to be the championship's doctor.

Mosley asked Watkins to become chairman of the newly formed Expert Advisory Safety Committee, which initially focused on Formula One safety research and development but later extended its remit to include closed car racing and, more recently, karting. The committee looked at ways to improve safety of the car, the circuit and the drivers' protective equipment.

An important aspect of the group was that, with funding from the FIA, it had the freedom to undertake whatever research it deemed necessary. No limits would be put on developing the safety of the sport.

It cooperated closely with the UK's Motor Industry Research Association (MIRA) and subsequently with the Transport Research Laboratory (TRL). Over the years the Expert Advisory Safety Committee has been responsible for introducing most of the major safety measures that have been brought into the sport.

It researched and introduced the collapsible steering column, protective foam around the top of the cockpit, new crash tests for front, rear and side impacts and the Head And Neck Support (HANS) device now worn obligatorily by every driver. It has also overseen many changes to the circuits, such as larger run-off areas in high-speed corners and reduced g-force corners to protect the drivers.

More safety features were brought into motor sport during that time than any other period. As Professor Watkins puts it: "In terms of safety, the last ten years have been a very successful era in Formula One."

At the beginning of 2004, Mosley came up with the idea of putting all of the research groups "under one roof" so that they could share resources and expertise. The FIA Institute for Motor Sport Safety was formed with funding from the FIA Foundation and Professor Watkins was appointed its President. The Expert Advisory Safety Committee became the OCRG and continued to lead research into all safety issues in motor sport identified in collaboration with the ASN's, the FIA Safety Commission, the FIA Medical Commission and other motor sport safety experts and research centres.

The OCRG's members include F1 team representative Pat Symonds, driver representative Michael Schumacher and F1 technical director Charlie Whiting as well other experts in the field of motor sport safety.

It initiates, monitors and reviews a number of safety programmes, which lead to new standards and new regulations drawn up in collaboration with the appropriate FIA regulatory bodies. The effects of these and other new measures on the safety of race events are continually monitored by the Group.

Current Projects*

Debris Fence

A project to improve the safety of debris fencing, circuit fences used to prevent debris from hitting spectators at the track.

There are two types of debris fence, those used at permanent circuits such as Silverstone and those used at temporary circuits such as Melbourne. This project has led to the creation of a computer modelling system which will be used to develop the ideal debris fence to protect spectators.

Ear Accelerometers

Sensors, placed in the drivers ear, which reveal more information about the forces on the driver's head during a race. Currently, accident data recorders on the chassis only report what the car is doing rather than what happens to the driver. Ear accelerometers will reveal what the head is doing as well. F1 teams Renault and Ferrari have helped with the evaluation of production prototypes by trialing the system during private tests.

High Speed Barriers

Work continues to develop efficient, high energy dissipating barriers. These types of barriers are often constructed using 'low cost' second hand or reject tyres, but to very controlled specifications and are already used extensively in motor racing.

Advanced barriers are being developed which will dissipate more energy in a relative short space, thus ensuring the car and

*As of 1st September 2006

driver do not become submerged in the barrier after the impact. *See Case Study page 32.*

Development of the Circuit Safety Analysis System (CSAS)

The CSAS is a computer tool which integrates detailed electronic image maps for the circuits with lap profile data from sensors fitted to the cars. Further information, regarding the performance of run-off areas has been collected from real accidents when cars run off the track. The CSAS tool is used to evaluate and specify the run-off areas and safety barriers at all Grand Prix circuits.

Car Launching Mechanisms ("Flycar")

This project aims to fully understand the mechanisms whereby open-wheel cars, especially those used in Formula One, often launch in the air when they collide. F1 teams Toyota and Red Bull have supplied carbon suspension parts and Bridgestone will provide F1 tyres to aid the project.

F1 Wheel Tether Testing

Wheel tethers are used to prevent wheels from flying off the cars but they also have to have enough elasticity to stop the car taking off with the wheel. Through rig testing, tethers have been developed which are able to absorb approximately eight times the energy of 2004 tethers. Testing continues with help from F1 teams, including McLaren and Honda.

Rear Impacts Seat

Prototype seats are to be developed using data from accidents in Indy Racing League cars in conjunction with Lumbar Spine modelling work carried out by Wayne State University. The results will look to optimise spinal stability and protection for the driver in rear impact accidents.

F1 Race Control Flag System

This project is examining the development of a system which will replace coloured warning flags during races. Instead, coloured lights will appear on the roadside and in the driver cockpit to show the status of the sector he is coming up to. The system works using GPS and radio signals and will eventually lead to the implementation of a complete automatic race control marshalling system.

F1 Side Impact

Full scale side penetration tests using 2005 F1 monocoques demonstrated the need for further development for the chassis side to fully resist penetration from either nose cone or rear pylon. Research has found that the best solution will direct the vast majority of impact energy away from the target car and into the front or rear crash structures of the bullet car.

This page:
The OCRG's "flycar" project aims to understand the mechanisms of car launching during collisions, as was the case with Christian Klien's Red Bull RB1 at the 2005 Hungarian Grand Prix.

Opposite page:
Intervention, signal and fire marshals at work at the 2006 Monaco Grand Prix.

Safety Training Working Group

The Safety Training Working Group (STWG) was created to work with the network of national sporting authorities to help raise the quality of training, particularly in emerging motor sport markets.

The Group has started to do this by developing the Global Best Practice Project, a strategy to create best practice in safety training around the world. The programme has been developed in conjunction with the Confederation of Australian Motor Sport and the UK's Motor Sport Association. An initial survey of current activities and training procedures of each major national sporting authority (ASN) was followed by the development of a detailed report which set out the criteria for benchmarking best practice.

The aims of the project are to provide recognition to those ASNs meeting these standards; create links between those who meet the standard and others who seek to do so; facilitate a knowledge exchange between ASNs; and encourage an ever higher quality of safety training provision. This will be achieved by creating pan-regional forums for the ASNs to work together. The FIA Institute's Centre of Excellence programme will establish a network of international facilities at which these forums can take place.

The first STWG pilot for the 'training the trainer' programme took place in Caracas, Venezuela in April 2006. It was attended by senior motor sport officials across the fourteen countries of NACAM, representing North America, Central America and Mexico, the largest FIA zone after Europe.

Led by Spanish federation Real Federación Española de Automovilismo, the main objective of the programme was to download the motor sport safety knowledge and expertise of experienced motor racing officials to the participants. The delegates took that knowledge back to their home countries and educated their own members.

FIA Formula One Race Director Charlie Whiting said: "It is fundamental that the knowledge and experience of countries that hold world-class events is shared. This type of event is especially beneficial to countries with less experience". Eventually, the STWG will set criteria and standards for an ASN's involvement in certain types of motor sport. Progress through those standards will be encouraged and grants will be made available to those ASN's which seek to improve standards but require further funding to do so.

It will be recommended that only ASN's and individual safety personnel that have achieved the required standard will be permitted to run major championship events such as Formula One and World Rally. This would incentivise the pursuit of higher safety standards and raise the level of professionalism in motor sport worldwide.

"It is fundamental that the knowledge and experience of countries that hold world-class events is shared."

Charlie Whiting, FIA Formula One Race Director

Closed Car Research Group

Marcus Grönholm and co-driver Timo Rautiainen in the Ford Focus RS, preparing for the next stage of the 2006 Acropolis Rally, Lamia, Greece.

The Closed Car Research Group (CCRG) is the first group of its kind to focus solely on safety in closed car motor racing. It was formed when the FIA Institute launched in 2004 and has focused research and development in this area.

The CCRG supervises all research into safety issues relating to closed cockpit racing cars, including GT cars, Touring cars and Rally cars. Its work involves a comprehensive investigation into driver and co-driver safety in a closed car environment, with particular focus on the restraint system, seat, roll cage, head protection and the safety cell structure.

These safety devices vary significantly from those used in open wheel racing and require a different approach. Many closed cars are production based with a number of safety features inbuilt into the chassis. In addition, the cars are fitted with a complete roll cage to reduce intrusion and maintain survival space during impacts and rollovers.

The wheels of closed cars are fully protected by body work, thus the potential for wheel ejection is reduced and the principal mechanism of car launching due to wheel contact is eliminated. The driver sits in an upright seating position which requires different belt geometries than the reclined seating position of many single-seater cars.

In addition to the design of the cars, closed car racing brings with it a different set of safety issues compared with open cockpit disciplines. In rallying, for instance, the cars have to deal with extreme terrains and aggressive structures such as trees and walls within close proximity of the race surface. Whereas in circuit racing a lot of safety solutions can be included within the track environment such as arrester beds and safety barriers. Closed cars also have to ensure protection during very high speed impacts, potentially in excess of 150 mph, a parameter that the majority of production cars are not designed for.

Even so, the cars' production background means that safety research is even more valuable in this area.

World Touring Car Champion Andy Priaulx, a leading safety activist amongst racing drivers, said: "The safety research on these racing saloons is even more important when we consider that they are closely derived from the standard road cars on sale to the general public. The car manufacturers have a chance to transfer the safety innovations adopted on the racing cars to their normal products."

Before the launch of the FIA Institute, closed car safety research was primarily handled by the Expert Advisory Safety Committee. This committee, which included amongst its members some of the major safety experts in motor racing, looked after research into all motor sport safety from Formula One to rallying and touring car. However, in 2003 the FIA decided that to maximise the approach different expertise were needed for the two different disciplines in motor sport safety. One group was put together for open cockpit, open wheel racing and another for closed cockpit, closed wheel. This development led to the formation of the FIA Institute the following year.

The CCRG became one of the FIA Institute's three major working groups at its launch. Its members now include some of the top experts in closed car safety such as FIA World Rally Championship safety delegate Jacek Bartos, Peugeot chief engineer Michel Nandan and Prodrive's David Lapworth.

Current Projects*

Closed Car Occupant Safety

This is the main part of the CCRG's work as it includes most of the areas of investigation in the short- and mid-term goals of developing a safety cell. Primarily aimed at the protection of rally crews, this work will be adapted for all closed cars.

It looks at all areas of the car and how the different safety elements interact. It encompasses the work on the FIA Seat Specification project. Another part of this project is side impact protection which converges with the other tests in this area. It is likely that the side impact work will be rolled out as a seat regulation as well as a car regulation.

This is especially relevant in rallying where the cars can hit stationary objects such as trees on the side of the road. The FIA Institute is looking at primary safety measures to stop rally cars from hitting trees in the first place. But in the eventuality that a rally car does hit a tree it is

"The car manufacturers have a chance to transfer the safety innovations adopted on the racing cars to their normal road cars on sale to the general public."

Andy Priaulx, World Touring Car Champion

*As of 1st September 2006

aiming to make that impact survivable at speeds in excess of 60 km/hour.

FIA Seat Performance Specification

The aim is to create a seat standard for a closed car (such as a rally car) with a safety level similar to seats used in Indy Car and Formula One. Testing has shown that this can be achieved. A side impact with 70g derived from a real NASCAR crash was performed successfully with a seat not much larger than current seats according to FIA standard.

With this, seat strength and stiffness testing was performed and a draft new FIA seat standard issued for discussion with seat manufacturers. Currently seats are built according to this draft standard. They will be tested dynamically to check the correctness of the static requirements, after which a new FIA seat standard will be issued. The aim is to create a specification for a low cost seat design, which can be adapted to go in any closed race car whether in rally, touring car or GT.
See Case Study page 36.

Testing Double HANS Belts

The initiative of double belts originally came from open wheel research and the CCRG is investigating whether it can be applied to closed car racing. It originated when some of the Formula One drivers complained that they did not feel the belts when wearing the HANS device.

This led to the development of a double belt – one to go across the shoulders so the driver can feel the belt and the other on the HANS device itself. This helped the drivers to feel strapped in and also offered advantages in roll-over situations because the belt on the body can be rooted down and restrain the driver better. Tests are now ongoing to see whether double belts should be fitted into closed cars.

Helmet and Airbag Interaction

This project aimed to determine 'best practice' for drivers wishing to take production vehicles on the track. Three options for wearing helmets were considered: no-helmet; open faced helmet; or full faced helmet. Two options for airbag status were considered: airbag on and airbag off.

It was concluded that a helmet should be worn at all times and that the airbag be activated. There was very little difference between the two helmet types; full faced and open faced, during the test conditions assessed but it is considered that a full faced helmet will provide greater overall protection than an open faced helmet.

This page:
2006 World Touring Car Championship, Round 6, Pueblo, Mexico.

Opposite page:
Professor Sid Watkins with the FIA Formula One Medical Car at the 2006 Italian Grand Prix, Monza.

The Medical Training Working Group (MTWG) seeks to improve medical education and training for motor sport medics. Its remit is to raise the standards of medical training across all motor racing championships worldwide.

Chaired by Formula One Medical Delegate Gary Hartstein, the Group's first task has been to create a modular motor sport medicine course that can be used to train trackside medical personnel.

Hartstein has been looking at ways to improve motor sport medicine since he began working full-time in Formula One in 1997 as an assistant to previous medical delegate Professor Sid Watkins. When Hartstein was appointed chief medical delegate at the beginning of the 2005 season he was determined to continue Watkins' progressive work. He said: "This is the first time that a course has been tailored specifically for motor sport and made accessible for anyone that needs it."

Most trackside doctors are qualified in Advanced Trauma Life Support (ATLS), which is widely regarded as the leading qualification available. However, it is not tailored to dealing with emergencies at trackside and is not considered the ideal course for motor sport medicine. This is because it is a hospital based course whereas trackside treatment is pre-hospital medicine. As such, training requires a location to put it into a practical context.

With this in mind, the MTWG has sought to create a brand new motor sport medicine course. To do this it has sought input from a vast pool of knowledge amongst its membership.

Members have been selected from motor sport markets all over the world to bring the widest amount of experience to the Working Group. They include Sid Watkins, Carl Gwinnutt, David Cranston (all UK), Gérard Saillant, Jean Duby, Jean-Jacques Isserman, Alain Chantegret (all France), Ronald Denis (Canada), Dino Altmann (Brazil), Nabeel al-Ansari (Bahrain), Masato Kito (Japan) and David Vissenga (Australia).

Between them, the members have created the curriculum for the course, which is set to be rolled out in 2007. Practical training will include trackside simulations that can provide practice for the whole spectrum of intervention personnel from fire crews and marshals through to medical and extrication personnel.

Hartstein said: "Having travelled round the world and spoken to doctors at established circuits with long motor sport history, like Silverstone and Indianapolis, as well new circuits, like Bahrain and Turkey, I realised that there is a very strong demand for furthering educational training in immediate care in the motor sport environment."

"There is a very strong demand for furthering educational training in the motor sport environment."

Gary Hartstein MD, Formula One Medical Delegate

Karting Research Group

The 2006 European Junior Intercontinental A Karting Championship, Braga, Portugal.

The Karting Research Group (KRG) was one of the three main research groups formed when the FIA Institute was launched in 2004. It is chaired by Professor Sid Watkins and includes among its members representatives from karting's governing body Commission Internationale de Karting, (CIK-FIA) the United Kingdom's Motor Sport Association and Germany's Deutsche Motor Sport Bund.

Before the CIK-FIA was launched in 2000, there was no dedicated committee for safety in karting, although occasional safety studies were commissioned. The speeds of the karts were controlled by a number of measures brought into the sport, which helped to maintain safety levels.

A stricter homologation for tyres was introduced to limit speeds. Safety devices such as side pods and other body work were brought in to offer more protection during collisions. The additional bodywork had the incidental advantage of increasing the weight slightly and thus reducing top speeds, although increased kart mass can, potentially, increase the risk of injury during rollover and the KRG is currently researching this issue.

However, it was recognised that maintaining safety levels was not enough and that only through extensive research could safety be improved. The first formal research group, the CIK Circuit and Safety Commission, was launched soon after the formation of the CIK-FIA. This group mainly looked at ways of improving the safety of the circuits and was attended by members of the participating national sporting authorities.

This helped to keep safety levels at a minimum but there was still relatively little research into the safety of karting itself. As such, karting was earmarked as one of three areas for the FIA Institute to focus on.

This has been an essential step in the professionalism of karting. It has helped to introduce the same levels of safety as seen in other motor sports such as Formula One. CIK-FIA President Luigi Macaluso, said: "When the Institute was launched in 2004 it was decided to set up a research group on karting to help the CIK with these studies. The KRG has introduced a huge amount of expertise and resources to the development of safety in karting. It has been a major benefit to the sport."

The KRG's early work focused on accident reports, statistics and analyses. It also looked at simulations and reproductions of kart collisions under test conditions. This allowed researchers to evaluate the priority safety measures to be researched and implemented in the sport.

Some of the results of that research have already been realised and put into practice. Following a proposal by the KRG, the CIK and the FIA World Motor Sport Council approved new regulations for 2006, introducing new safety equipment to the sport that will offer further protection in kart-to-kart collisions.

Other research projects include helmets for young drivers, chest protectors, safety steering columns and an imminent study on rollover protection by high seat designs.

Current Projects*

Helmets for Young Drivers

This is the first ever project to develop safety equipment specifically for young drivers. This is essential as all driver helmets are currently made for adults - making them smaller does not do the same job for children. The need for such change was promoted by orthopedic surgeon Dr. Terry Trammell, a motor sport specialist. The FIA Institute began funding essential research into this field from its inception in 2004.

The KRG has worked in conjunction with the Open Cockpit Research Group to progress the project. A huge amount of children's head mass and head geometry data has been collated and analysed by FIA Institute Fellows Dr. Trammell and Dr. Steve Olvey. The data was used to create 3D models representing the average size, shape and mass of a child's head for two age groups, seven- to 11- and 12- to 16-year olds. The 3D forms were sent to a helmet manufacturer to produce prototype helmets to an FIA Institute specification.

The project will lead to the creation of a Youth Helmet Standard that will be adopted by various race series, with other potential applications including winter sports, extreme sports and equestrian activities. *See Case Study page 28.*

*As of 1st September 2006

Kart to Kart Impact

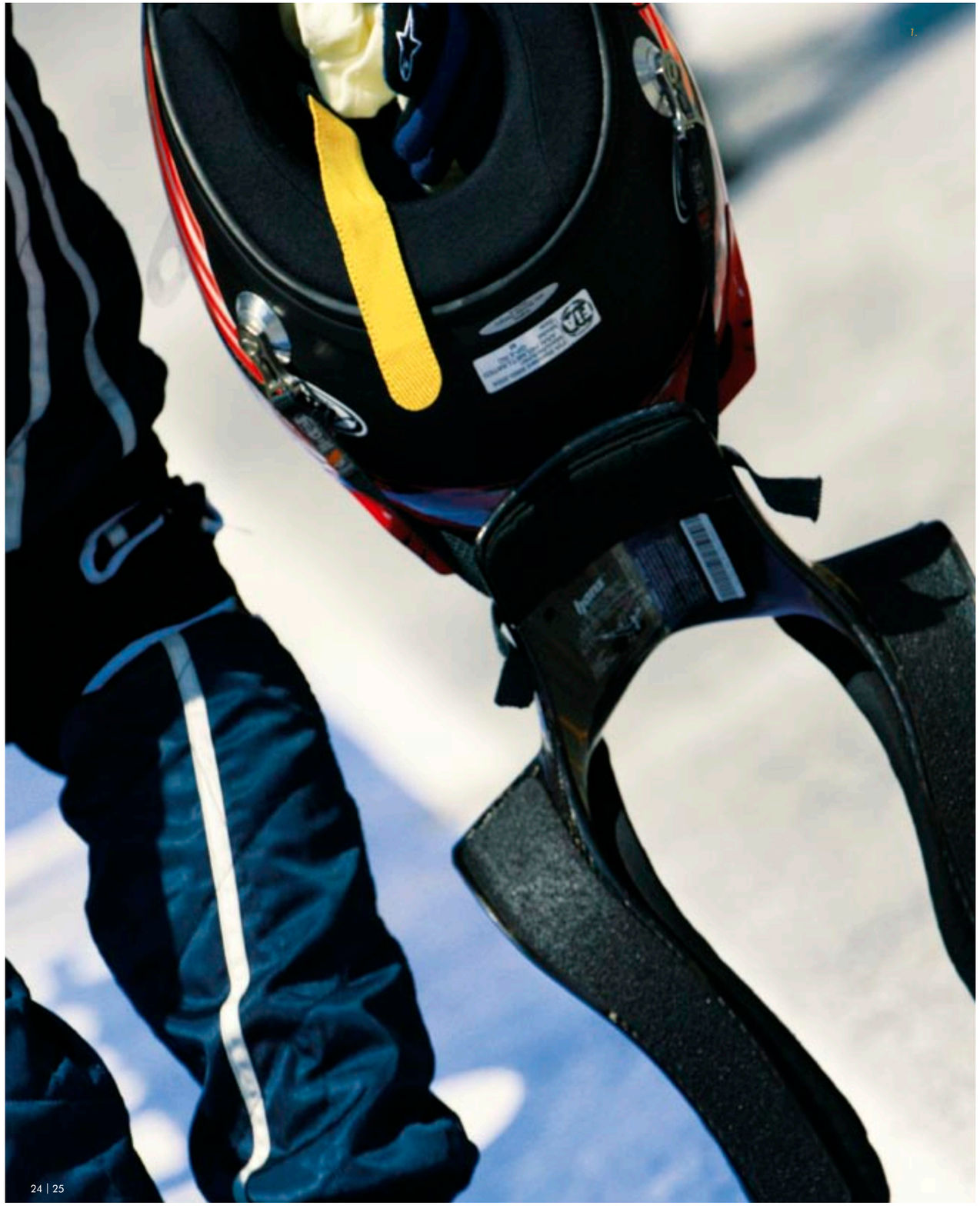
Further to the research and tests into kart-to-kart impacts, a new CIK-FIA Technical Regulation for rear protection was approved by the KRG on 28th November 2005. The World Motor Sport Council formally approved the new rear protection Technical and Homologation Regulations on 9th December 2005.

This regulation enforced all competitors to fit an homologated rear wheel protection or anti-launch bumper to prevent the rear wheels of the kart in front engaging with the kart behind, which could result in kart launching or even rollovers. The new rear wheel protection system was used by all competitors during the 2006 CIK-FIA Karting Championships and will be progressively introduced by ASNs in their own national championships.

Chest Protection

Accident data has shown that chest impacts are the predominant cause of serious injuries in karting. The steering column often contributes to this type of injury.

The KRG has taken two approaches to solve this problem. In the short term it is developing improved body protection as part of the drivers' Personal Protective Equipment, this being relatively quick to develop and implement. In the longer term advanced steering columns will be developed which are significantly less aggressive to the driver. The final solutions will be low cost with the objective for retro-fitting to current karts as well as original equipment on new karts.



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1. Every F1 driver wears the HANS device, produced conforming to the FIA 8858 2002 standard.

2. Puma mid-ankle racing boot.

3. Formula One race suit.

4. Sparco racing glove.

5. Bridgestone Formula One tyres.

6. Arai racing helmet.

Industry Liaison Group

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The Industry Liaison Group (ILG), formed in September 2006, is the most recent addition to the FIA Institute's structure. The Group works as the interface between the FIA Institute's research and the manufacturers who put the results of that research into the market. It is therefore an essential component in bringing safety to all levels of motor sport.

The ILG works in two ways. It provides a forum for a detailed dialogue between the industry and the FIA Institute's research team. And it offers the manufacturers the chance to become partners in the FIA Institute's various projects.

This is necessary to enable the FIA Institute's working groups to maintain a dialogue with the manufacturers and deliver standards that are appropriate to the market. For instance, there is little point in inventing a new safety measure if it uses exotic materials and is very expensive to produce. The findings of the research must be cost-effective and of the right standard for the manufacturers and vendors that produce and sell the items. The ILG will help to guide those standards.

The FIA Institute has always worked in close collaboration with the safety industry but on a project by project basis. The ILG offers a platform to extend and develop that relationship.

The ILG's members include the major companies involved in manufacturing safety equipment such as helmets, race suits, HANS devices and safety harnesses. A further benefit of this membership is for the FIA Institute to utilise the resources of the manufacturers and vice versa.

The ILG holds around three meetings a year where members are invited to discuss current projects, areas of potential research and trends in motor sport safety. It also runs a number of workshops which offer a closer examination of individual projects. The first workshops focused on the youth helmet project and a project looking at the introduction of a new FIA seat performance specification.

It is envisioned that by involving the industry it will help facilitate the whole process, from research and development to design and production. This will, in turn, benefit the end user as they will receive an improved and generally cheaper product in less time.

Membership to the ILG is not just open to safety equipment manufacturers but all sectors of the motor sport industry with an interest in safety, including circuits, motor racing teams and test houses.

28 | Young Driver's Crash Helmet
32 | High Speed Safety Barrier
36 | New FIA Institute Seat Standard

Case studies: How our research projects make a difference.

The Red Bull Racing RB2 on the grid at the 2006 Italian Grand Prix.

Case Study 1: Young Driver's Crash Helmet

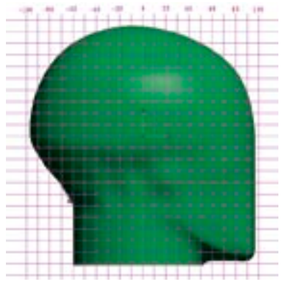
By Mark Hughes, Grand Prix Editor, Autosport

Among the many FIA Institute projects, one of the most ground-breaking is the development of a young person's crash helmet. Few people in the industry would have theorised even 10 years ago that a young driver's helmet should not be just a smaller version of an adult one. But that is one of the discoveries that has been developed by the FIA Institute and its partners, since it launched in 2004.

No doubt this area would have been explored by one of the major safety manufacturers in due course but not with the speed and commitment that the FIA Institute has employed. Indeed, in just under two years it has researched and developed a brand new way of thinking in this area. Under the guidance of FIA Institute project manager Andrew Mellor, the project aims to introduce a helmet to junior kart racing that is specifically designed for the physique of two youth age groups: seven- to 11- and 12- to 16-year-olds. Already the Snell Memorial Foundation – which has been certifying helmets in the US in a variety of sports since 1957 – is committed to working with the FIA Institute and the FIA in the joint publication of a new FIA youth helmet standard.

A young kart driver in action.

Young Driver's Crash Helmet



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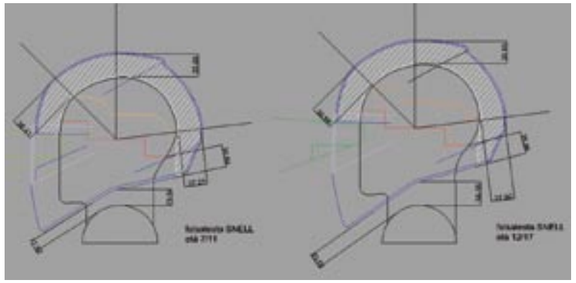

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The need for such a helmet was first identified by American orthopaedic surgeon Dr. Terry Trammel, a motor sport specialist, and expert race medic Dr. Steve Olvey. They found that smaller versions of adult helmet designs – all that are currently available on the market – were of inappropriate geometry and mass. Trammel and Olvey, both Fellows of the FIA Institute, collected size and mass data using young volunteer subjects. The FIA used this data to build 3D surface models of the heads and shoulders of young karters. These models were used to create the first prototype helmets.

"Although current helmets worn by kids do offer good protection there is room for improvement," points out Mellor. "Young heads are lighter than adults so their helmets should be softer. Also, relative to their bodies, kids' heads are big but their necks are thinner and weaker so their helmets need to be lighter. Their necks are also shorter so a miniaturised adult helmet tends to rest on their shoulders, creating a gap at the top and also potentially putting impact loads through the wrong path, the neck providing a pivot point." This inappropriate shape can also mean less than optimum vision out of the helmet.

Previous research has established that although a four year old's head size is typically 90 per cent of that of an adult's and a 12-year old's 95 per cent, their necks are not equivalently sized. A typical four-year old neck is only around 75 per cent of adult size, with a 12-year old's typically 85 per cent. Combined with their weaker muscles, it means that their necks are more susceptible than adults to injury from tensile, compressive and bending loads.

The mass of the helmet is therefore critical. A delicate balance is required between impact protection and helmet mass. Using stronger shells and thicker liners can improve impact protection, but add mass to the helmet. The greater the mass acting upon the head during an impact, the greater the chances of neck or spinal injuries.

The challenge is therefore twofold. Firstly, to ensure the impact loads are travelling through the most appropriate load path and, secondly, to use material and construction that allows full impact protection with a mass that is low enough to give adult levels of protection from neck and spinal injuries.

A typical current youth-sized helmet weighs around 1.6 kg but research has shown this is too heavy for most necks of that age to adequately support in impacts. Although a definitive target weight has yet to be set for the youth helmet, it is expected to be around 1.2 kg even though it must still give adult levels of protection. This 400g reduction represents a huge reduction in the loads imparted to the wearer's neck during an impact.

Despite the significant weight reduction the helmet will still have to pass all of the stringent tests required by Snell and the FIA. These comprise tests involving impact, roll-off, dynamic retention, shell penetration and visor penetration.

Even with these stringent tests in mind the design target is for a super-light, small helmet with the correct geometry, excellent impact performance – and all for a target retail price of no more than $300. This is especially important because a relatively easy way around the conflicting requirements of low mass and high impact protection would be the use of more exotic and expensive materials. However, this would make the helmet unaffordable for many competitors.

A number of prototypes have been produced of the correct geometry that weigh no more than 900g and with impact performance equivalent to current adult race helmets. The unit cost of production looks set to achieve the target retail price.

The next step is to pilot the new helmet design – with four different geometries – into targeted kart race meetings. This will be done through the Commission Internationale de Karting and the national sporting governing bodies. If all is satisfactory in these initial targeted trials, the FIA and Snell will proceed with publication of a new standard to guide helmet manufacturers.

When at least two manufacturers are making them, the sanctioning bodies for each race series will have the option to make helmets to this new standard mandatory. It is envisaged that once the design is established in these initial markets it will lead to widespread acceptance worldwide.

The public product is set to be on the market by late 2007. That's a major achievement when you consider it took over seven years to develop the latest FIA 8860 helmets, currently used by all drivers in Formula One.

The new helmets could even have a wider ranging impact. Not only will they prevent injury for young drivers but they will aid safety in other sports. The International Ski Federation (ISF) and the US Ski Association (USSA) are both actively interested in the programme and have maintained a dialogue with the Fellows of the FIA Institute. The research would be also applicable to other sporting events where children require improved protection from head impacts such as equestrianism.

As Mellor puts it: "We are pushing to create an international standard that will help all young athletes that require this type of protective equipment."

4.

1. 3D surface geometry of an average youth head.

2. Current test head form.

3. Evolution of helmet surface geometry.

4. A young driver at the 2006 CIK-FIA European Junior Championship, Mariembourg, Belgium.

Case Study 2: High Speed Safety Barrier

By Michael Schmidt, Formula One Editor, Auto Motor und Sport

Inter-connecting TecPro blocks form part of the FIA Institute's high speed barrier at the second chicane of the Monza Circuit.

Barriers that can protect drivers in high speed incidents are essential in open wheel racing. With short run-off areas at some corners, especially on traditional circuits such as Monza and Spa, a driver can often find himself hurtling towards a barrier at speeds in excess of 200 kph. For this reason the FIA and the FIA Institute have been focused on developing an ingenious solution – a barrier able to protect drivers in high speed impacts, at even the most constricted of circuits.

This special barrier, which can dissipate energy in a way that minimises injury for the driver, has been over six years in the making. It is set to revolutionise circuit safety. This is because it can absorb the energy of a 187 kph impact in just four metres whilst keeping the g-forces on the driver within acceptable limits.

The accident which triggered this particular research was Michael Schumacher's crash in the 1999 British Grand Prix at Silverstone. The Ferrari driver left the track after a brake failure at Stowe corner at 204 kph and hit the tyre barrier at 107 kph. Incredibly, apart from a broken leg, the seven-times-world champion had no other injury.

However, FIA safety expert Peter Wright later recognised that Schumacher had a lucky escape. By studying data after the race, Wright found that the driver was particularly fortunate not to suffer any head injuries.

Wright contacted Hubert Gramling, a German engineer and crash-test expert, who had assisted the FIA already in the development of the Head And Neck Support (HANS) system. He asked his colleague to develop a barrier which gives the driver the best chance to survive a high speed crash without any serious head injury. That conversation led to a six-year sequence of calculation, computer simulation, brain-storming and testing in collaboration with German automotive safety group DEKRA, which would culminate in a leap forward for modern motor sport safety.

First, Gramling developed software to simulate the momentum from a crash at any given speed for different types of barriers. Using this programme he examined the crash data from different types of accidents. He found that some drivers had walked away unharmed from high-speed impacts whilst others were injured in seemingly less severe incidents. For instance, at the Spa-Francorchamps circuit in 1999, Jacques Villeneuve hit the tyre barrier at 190 kph and his car was brought to a standstill in 400 milliseconds over a distance of just seven metres. Yet he walked away unharmed. By analysing this data Gramling could develop a model of a barrier which would give the driver the ideal crash momentum.

A computer model was developed which showed the driver's movement in the car during a heavy impact. Gramling's first simulation was with a barrier with five separate layers. Using the computer programme he worked out the consequences from all possible combinations. "Within minutes we simulated over five million scenarios," says Gramling. The research showed that the best solution was to allow the

High Speed Safety Barrier

1. Michael Schumacher crashes heavily into the tyre barriers at Stowe on the first lap of the 1999 British Grand Prix.

2. A TecPro block.

3, 4 & 5. Testing of the high speed barrier at DEKRA.

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driver a relatively high g-load level - a speed reduction of approximately 40 kph - during the first part of the impact.

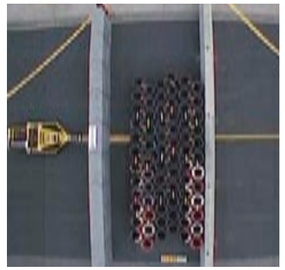
The initial part of the impact is not very critical because the driver has some space to move forward before the tightening of the seat belt, which in itself has some elasticity. In this phase the head often hits the steering wheel, where forces need to be reduced. The speed here should not pass five to seven metres per second (m/s). Schumacher for example hit the steering wheel in Silverstone at just 5.8m/s. But had there not been so many rows of tyres at Stowe corner it could have been easily 12m/s. Any speeds above 8m/s can be critical for the driver.

However, not every circuit has so much space available as the run-off area of Stowe corner. So Gramling came up with a theory that could solve this problem. The idea was to manoeuvre the driver in the first part of the accident inside the car to a position where he can sustain high loads in the latter part of the accident. This is what the tyre wall did in the Schumacher accident and explains the relatively small injury in such a major crash.

The car would also transfer the momentum of the first part of the impact onto the second layer of the barrier. Gramling explains: “It is just the same as what happens in a multi-car pile up. The first car gives its energy to the next one and so on”.

A first test was conducted with a 20mm thick conveyor belt placed in front of a tyre wall. However, with an impact speed of 80 kph the belt started to tear. At 100 kph the trolley penetrated the belt. “It was total destruction,” says Gramling. Strengthening the belt did not provide a solution either and, in fact, the barrier became so stiff and heavy it would be impractical for circuit use.

2.



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The tests also revealed a problem with the theory. Gramling explains: “The concept of a momentum transfer in two phases could not be made to work without accepting other downsides. What we needed was a consistent deceleration over the whole impact.”

After the tests with the conveyor belts had failed, the FIA received a call from French company TecPro International, which had designed some energy absorbing containers and wanted to work with the FIA on future projects. Gramling saw an opportunity and asked TecPro to donate these elements for testing with a view to future purchase. TecPro agreed.

The TecPro blocks are containers measuring 1.5m long, 1m high and 0.6m deep. Each end is formed like a half circle, enabling them to connect with each other like a jigsaw puzzle. Nylon straps hold them in place.

At the start of the experiment the containers were filled only with poly-aethylen foam, a substance known to absorb high energies. Using a trolley with a front nose similar to an open wheel race car, which was specially developed by the FIA Institute, DEKRA commenced the test at its facility in Neumünster. At the first attempt the trolley crashed through the barrier just as it had with the conveyor belts. So to stop penetration, two 2mm steel sheets were placed vertically in the centre of each container with 30cm layers of foam on each side. The overall weight was 140 kg for a container, a feasible amount for two trackside marshals to handle.

The second test, at an airport in Itzehoe, took place with two rows of steel armed blocks. It worked. The trolley crashed into the structure at 127 kph and stopped without any penetration of the barrier material. The driver would have had to sustain only 30g during impact.

As chance would have it, Gramling realised that the data from this test correlated exactly with the data taken from a crash involving Felipe Massa at the Monaco Grand Prix in 2002. The Brazilian, who then drove for Sauber, had hit the tyre wall at Ste. Dévote corner at exactly 139 kph, following a brake failure. Massa also experienced a deceleration of just 30g and was unharmed.

Gramling soon realised that by combining the Ste. Dévote tyre wall with the TecPro barrier he could create the ultimate safety device.

But there was still some fine-tuning to be done. The TecPro blocks were followed by four rows of tyres with a gap of 2m in between. In the middle of the tyres, tubes of high density poly-aethylen were inserted. Behind this was a final barrier, which was a special retaining wall supplied by German company Bernd Spengler. With this barrier a 173 kph impact was managed at a deceleration of 65g. A final crash test in 2006 proved to be the culmination of the previous six years work. The trolley was driven at a speed of 187 kph into a barrier made up of only one line of steel-armed TecPro blocks, followed by a 1.2 m gap (shortened to improve efficiency), then six rows of tyres with poly-aethylen inserts and finally a moveable retaining wall. The whole barrier was just four metres deep and the result was stunning. With a deceleration of 55g for the driver, the load was way within acceptable limits.

The accumulated data helped to develop this type of barrier for all kind of corners and run-off areas. As Gramling puts it: “We now know how big the gap between the TecPro blocks and the tyres has to be and how many layers of tyres we need for a given impact speed.“

It all bodes well for the future. Gramling says: “With what we know after all these tests we are confident that the barrier we tested at 187 kph can master a 210-220 kph impact in a limited area.” The research has delivered another positive result. The construction of the TecPro blocks has the added benefit of preventing the car from getting stuck in the tyres because the car carries the blocks with it into the next barrier. This will undoubtedly help safety marshals gain access to the driver immediately after an incident.

The research became reality in September 2006 when the barrier was used for the first time at a Formula One circuit for the Italian Grand Prix in Monza, where it was installed at the end of the run-off areas at the circuit’s second chicane and Parabolica corners. The FIA and the FIA Institute were delighted with the installations at Monza and have begun discussions on the feasibility of similar installations at other tracks around the world. It represents yet another step into a new chapter of safety led by the FIA Institute’s ongoing campaign.

“With what we know after all these tests we are confident that the barrier we tested at 187 kph can master a 210-220 kph impact in a limited area.”

Hubert Gramling, FIA Institute Project Manager

Case Study 3: New FIA Seat Standard

By Mark Hughes, Grand Prix Editor, Autosport

Marcus Grönholm, in the Ford Focus RS at the 2006 World Rally Championship, Sweden.

The driver's seat is a core component in a closed cockpit race car. Not only does it provide the main connection between the driver's body and the car but it also provides the last line of protection should an accident occur. This is why an important part of the work conducted by the FIA Institute's Closed Car Research Group (CCRG) has focused on developing and improving seat design.

By developing improved seat designs, the FIA Institute can promote enhanced safety for all drivers in closed car disciplines. Given the potential benefits of safer seats, the FIA Institute has commenced a project to develop a new seat specification which may, subsequently, be published as an FIA Standard.

Although focused initially on rally seats, the technologies established by this project will transfer to other race series The ultimate aim is to create a new seat specification which will provide closed cars with similar levels of protection to Formula One and Indy Cars.

Some of the research, both engineering and medical, may also be relevant for road cars. Wright says: "This project will establish a best practice for design and installation. The FIA will then legislate the standard with a formal regulation."

Some of the research, both engineering and medical, may also be relevant for road cars.
In this way it is hoped the programme will not only enhance safety for competitors but will also underline the value of motor sport to the car industry.

1. Yvan Muller prepares for Round 5 of the 2006 World Touring Car Championship in Curitiba, Brazil.

2, 3, 4 & 5. World Rally side impact development testing at DEKRA.

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"Every car built in the future will be fitted with a seat to the new FIA standard."

Peter Wright, FIA Safety Commission President

The need for improved seats became increasingly apparent following the introduction of the Head And Neck Support (HANS) device into motor racing. Wright says: "We've achieved a lot of improvements to the cockpit environment for open cars and successfully integrated HANS with many series. What became very apparent when we formed the CCRG was that we needed to reinvestigate the seat and cockpit for closed cars."

Unfortunately, most of the open wheel safety research cannot be transferred directly to closed cockpit cars.

"The whole environment is different," says Wright. "In a closed car you are sitting inside a strong roll cage so there are more things for you to hit. Also, the seats are discrete rather than built into the monocoque as for open cars. The way they are mounted, particularly for different sizes of driver, and the strength of those mountings becomes very important. There are a lot of areas of driver and seat integration that need to be addressed."

Rallying, specifically, brings further safety considerations arising from having two occupants in the car and the different types of terrain the car has to negotiate over the course of the season.

The general aim for any vehicle safety system is to ensure the occupant's rate of deceleration does not exceed those levels that may inflict injuries and that all the available space is used efficiently to minimise the peak loadings.

Dr. John Melvin, a fellow of the FIA Institute, has been leading research in this field for four decades, his work informing many of the standards for the American car industry. Using the huge amount of data made available from motor sport accidents during the last few years, particularly in NASCAR, Melvin has been able to refine his understanding of human injury toleration in impacts.

NASCAR has conducted a vast amount of research in this area, especially following the death of star driver Dale Earnhardt. This gave the CCRG a starting point for its own research.

Wright says: "We worked closely with John Melvin in the US and we have commissioned the Delphi test facility in the US for our sled testing. We took our start from the NASCAR research and adapted it for the type of cars and circuits used outside the US."

It became clear during Melvin's research that much of the established data on human tolerance to injury was not quite accurate and that injury tolerance levels were somewhat higher than previously believed. This means that the forces and accelerations, imparted by a safety system, can be made more aggressive to make an accident more survivable.

During an accident, the car stops very quickly with a deceleration measured in terms of g-loadings. In simplified terms, the occupant continues to move at the speed the car was travelling immediately before impact until the torso is either restrained by the safety harness or impacts with part of the car's interior. Following the restraint of the torso, the internal organs may continue to move within the body thus causing internal injuries. Controlling the relationship between these motions, in order to minimise the risk of injury, is fundamental to this research and a key part of the seat project.

Keeping the average acceleration on the car below 60g should, in most circumstances, make the accident survivable provided the relative motions between the torso, head and neck are also controlled. The use of an approved Head Restraint System, such as HANS, mandatory in F1 since 2003, and with extensive take-up in other racing series too, has made achieving these aims considerably easier.

During frontal impacts the HANS device directs the initial forces of the driver's head, that would otherwise go through the neck, through tethers connecting the helmet to the HANS collar and then into the restraint system. This greatly reduces the chances of spinal or base of skull injuries caused when the body is arrested but the head free to move unrestrained.

However, during side impacts, in closed-cockpit cars without the padded cockpit sides of single-seaters, the lack of an adequate head and shoulder restraint can still result in neck or spinal injury.

The FIA Institute is looking at ways of introducing more material to the sides of the seats around the occupant, to help increase protection in side impacts. Wright says: "If the seat is strong enough, and fitted with an appropriate energy management system, it can prevent the occupant from hitting the side of the car. That needs to be done at the pelvis, the shoulders and the head. It must also restrain the occupant in the correct position."

Much of the research has been conducted in co-operation with Peugeot and Prodrive with engineering design by the Subaru World Rally Team. A high-g sled at Delphi in the US has been commissioned for development testing. It has demonstrated that a high velocity 70g side impact is, theoretically, totally survivable, with zero injury. This was achieved with a seat only very slightly larger than those meeting the current FIA standard. Subsequent side impact development test work to evaluate chassis integration has been conducted at DEKRA in Germany.

As well as outlining the geometry of the seat, to ensure appropriate support of the occupants body, the FIA Institute plans to prescribe values for stiffness, strength and installation. Correct mounting of the seats and belts is absolutely crucial in their effectiveness and, therefore, needs to be included as part of the specification.

Then it is just a case of getting the seat out into the market. As Wright puts it: "The biggest gain will be getting everyone to use it." Here the FIA Institute will utilise the newly formed Industry Liaison Group, which works as the interface between the research groups and the manufacturers. This will ensure that every new seat and all new cars satisfy the new requirements.

As Wright says: "We will work with the Industry Liaison Group to cooperate with the seat manufacturers and make sure they start building these seats and seat systems as soon as can be achieved. So every car built in the future will be fitted with a seat to the new FIA standard."

The Centre of Excellence programme recognises and rewards excellence in safety at circuit facilities around the world.

Formula One Testing at the Paul Ricard Circuit, France. March 2004.

FIA Institute Centre of Excellence Award

1. Race control at the Chinese Grand Prix, Shanghai.

2. Bahrain International Circuit.

3. Shanghai International Circuit.

2.

3.

The Centre of Excellence programme forms the cornerstone of the FIA Institute's aim to encourage and incentivise excellence in all aspects of motor sport safety. The award recognises and rewards excellence at circuits around the world.

Each Centre of Excellence exemplifies the high standards expected by the FIA Institute in terms of medical, marshal and race control safety. They also display a commitment to innovation and the development of new safety technology.

In return, each Centre of Excellence, is utilised to host events under the auspices of the FIA Institute. The first recipient of the award, the Paul Ricard circuit, is to host the first FIA Safety Summit in January 2007. This will become an annual event, building on the success of the joint safety symposium between the FIA Institute and the International Council of Motorsport Sciences (ICMS), held in Rome in 2006.

The centres also act as hubs for best practice in various motor sport regions around the world . In order to become an FIA Institute Centre of Excellence, a circuit must first go through a nomination application process. Each nomination is assessed by a jury, made up of leading international experts in the field of motor sport safety as well as officials and competitors.

The Paul Ricard High Tech Test Track, in Le Castellet, southern France, was chosen to be the first recipient of

FIA Institute
Centre of Excellence

1.

1. Bahrain International Circuit is unique in holding a number of night-time events.

2. Helicopter and Medical Centre at the Paul Ricard Circuit, France.

1.

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the FIA Institute Centre of Excellence award. At least two other circuits in different continents, which have been put forward for nomination, are under consideration for the award.

Paul Ricard was selected because of its high safety standards and its continual developments in this field. It boasts a number of unique safety features. For instance, the circuit has 25 acres of run-off areas, made from a special type of asphalt rather than the gravel beds used at other circuits.

Gravel traps have been replaced by three types of asphalt surface. The first, on the outside of the track and painted blue, is more abrasive than the track itself. The second, painted red, continues on from the first and is ultra abrasive. The third type is a white asphalt surface, which is thought to be more effective at slowing the cars than the grass layers used at other circuits. The surfaces are varying blends of asphalt and tungsten, designed specifically to intensify the slowing down and stopping effect on cars. This type of run-off system increases safety, reduces the intervention time of the rescue teams and reduces damage to the car.

Another unique feature is the replacement of flag marshals with a system of lights. Activated by transponders on the cars, this system reacts quicker for the drivers and rescue teams. Thirty-three traffic lights strategically placed around the circuit inform drivers instantly of potential hazards on the track.

The bonus of this system is that the track marshals can be used in other areas such as helping with the rescue teams. Paul Ricard employs a number of permanent marshals and has available between five and 20 rescue teams depending on the number of cars using the track. Each team consist of two track trained safety marshals with experience in rescue techniques.

The medical centre at Paul Ricard is particularly advanced. Facilities include a medical helicopter landing pad, with its own fully equipped resuscitation ambulance, a two-bed observation ward with full medical equipment, full life-support facilities with two emergency sections and a serious burns unit with appropriate bath.

It employs nine permanent staff, including a chief medical officer, an anaesthetist nurse and a number of trained firemen.

The medical facility is also used as a training centre for track and road emergencies. It has a state of the art SimMan Dummy, a mannequin which can simulate 2,500 injuries and be operated on. There are only a few of its type in France with the others used for army training, in universities and at hospitals.

FIA Institute President Professor Sid Watkins is particularly impressed with the circuit. He says: "Paul Ricard has proved itself to be one of the safest tracks in the world and its medical facilities are second to none."

Paul Ricard has already hosted international training forums for the FIA Institute with a particular focus on extrication training. This programme is set to continue as the Centre of Excellence programme expands internationally and a network of 'hubs' for the training of medical and safety personnel is created.

Watkins says: "Our Centre of Excellence Programme is set to roll out across established and emerging motor sport markets worldwide. The close liaison with national sporting authorities as well as the key industry players will encourage new safety partnerships to flourish."

The Centre of Excellence award is the first phase of a wider excellence programme that the FIA Institute plans to roll out. The programme will eventually involve awards for Excellence in other areas of safety. For instance, new safety developments, new technologies and even individuals will be rewarded for excellence in their specific field. With such incentives, the FIA Institute hopes to increase innovation and excellence in safety in a way that will improve motor sport, technology and practice.

"Our Centre of Excellence programme is set to roll out across established and emerging motor sport markets worldwide. The close liaison with national sporting authorities as well as the key industry players will encourage new safety partnerships to flourish."

Professor Sid Watkins, FIA Institute President

The FIA Institute: Putting Safety First.

David Lapworth
Engineering Director, Prodrive and Member of the Closed Cockpit Research Group

"Prodrive has been more than happy to assist the FIA Institute on a number of research projects which have sought to develop and improve safety in motor sport. The FIA Institute has hugely accelerated research and progress in this area since it was formed and it is important that the industry supports its work."

Mario Coletti
Brand & Marketing Director, Sparco S.p.A.

"The FIA Institute for Motor Sport Safety is playing a fundamental role as an independent body which actively promotes the development of safer products for the whole community involved in motor sport."

Martina Kindt Cohen
CEO, Bell Helmets Europe

"I think that the FIA Institute is a great improvement for all of us involved in safety. It has been the driving force behind many groundbreaking new technologies. Never has safety made such quantum leaps since the FIA Institute made it its priority."

Michael Krehl
Project Manager Crash Tests, DEKRA Automobil GmbH

"The cooperation between the DEKRA Crash Test Center and the FIA Institute for Motor Sport Safety has been very professional, effective and forward-looking. I think the many tests we have worked on together will result in more safety for the drivers and the attendants at racing events."

Jost Capito
Director of Ford TeamRS

"As a manufacturer entered in the FIA World Rally Championship, Ford places the highest priorities on safety. It is good to know that an organisation like the FIA Institute is working on motor sport safety day in and day out. Between us we will strive to make rallying and other motor sports as safe as they can be."

Hal Fenner
President, Board of Directors, Snell Memorial Foundation

"As President of the Snell Memorial Foundation I have had the opportunity to work with the FIA Institute during the past few years. Not only has the Institute been very cooperative but it has been a huge help in the design and innovation of improved head protection for all drivers from karting to Formula One."

Mark Stiles
CEO, HANS Performance Products

"Having an open discourse with the FIA Institute over the past few years has made it easier for us to ensure that racers get the best possible performance from their HANS Device. The FIA Institute's expert researchers have created specifications that have challenged us to construct pragmatic solutions to enhance racer safety in subtle but important ways. This contribution has been invaluable."

The FIA Institute improves the safety of motor sport through analysis, research, testing and development.

Front Cover: Pit lane exit stop light at the Autodromo Nazionale di Monza.

The Renault F1 Team during a pit stop at the 2005 French Grand Prix.

02 | Welcome

04 | Introduction

06 | What the Drivers Say About the FIA Institute

08 | About the FIA Institute and its Objectives

10 | Structure of the FIA Institute

Contact

FIA Institute for Motor Sport Safety
8, Place de la Concorde
75008, Paris
France

Richard Woods
Director General

Tel: +33 1 43 12 44 55
Fax: +33 1 43 12 61 68
Email: info@fiainstitute.com

www.fiainstitute.com

Back cover:
The blue pit lane light indicates to race drivers a car on track is approaching its pit lane exit.

Opposite page:
Fernando Alonso, 2005 FIA Formula One World Champion.