FORMULA STUDENT GERMANY

INTERNATIONAL DESIGN COMPETITION

August 2nd - 7th 2011
Hockenheim

formula student germany

PROGRAMME 2011

presented by VDI

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A SPECIAL THANKS GOES TO THE NUMEROUS VOLUNTEERS WHO CONTRIBUTED SIGNIFICANTLY IN THE REALISATION OF THE SIXTH FORMULA STUDENT GERMANY

Welcome to the future!

Ladies and Gentlemen!

We are pleased to welcome you to Formula Student Germany. This year's event at the Hockenheim Ring has once again grown and improved with thanks to the help of sponsors, judges, volunteers and especially the teams. We hope you have a great experience and a lot of fun at this year's event.

Formula Student Germany is not about quantity and quality but about the future. The future appears in the form of almost soundless race-cars that show driving performances beyond the imaginable and in the form of innovations that have been developed and presented by the teams. All this takes place within the view of experts. Perhaps not the biggest innovations are to be found at Formula Student Germany but most certainly the biggest innovators of the future, our future. The participating students speak English fluently and work within global networks disregarding cultural differences. Reservations do not exist and mutual support exists beyond all bounds. All this is what society and industry expect from their future specialists and managers and what they can already find at Formula Student Germany. The most exciting part: at Formula Student Germany there is the possibility to talk to more than 2500 ambassadors of the future, in more than 20 languages.

Formula Student Germany is a gathering of the engineers and innovators of the future. Come allow yourself to become immersed and see and experience the future.

Welcome to Formula Student Germany 2011.

Dr. Ludwig Vollrath (VDI e.V.)
Tim Hannig (FSG e.V.)
and the Formula Student Germany Team

Willkommen in der Zukunft!

Sehr geehrte Damen und Herren,

es freut uns Sie bei der Formula Student Germany willkommen heißen zu dürfen. Das diesjährige Event auf dem Hockenheimring ist wieder, dank der Hilfe von Sponsoren, Juroren, Ehrenamtlichen und insbesondere der Teams, größer und besser geworden. Wir hoffen sehr, dass Sie das ebenso erfahren und Freude an und auf dieser Veranstaltung haben.

Größe und Güte allein stehen bei der Formula Student Germany jedoch nicht im Fokus. Vielmehr die Zukunft. Diese ist hier so greif- und spürbar wie an sonst keinem Ort der Welt. Sie zeigt sich beispielsweise in Form von fast lautlosen elektrischen Rennautos, die Fahrleistungen jenseits der Vorstellungskraft beweisen und natürlich anhand von Innovationen, die die Teams entwickeln und vorstellen. Teils unter den begeisterten Blicken der Fachwelt. Es mag sein, dass Sie hier nicht unbedingt die größten Innovationen finden, sicher aber die größten Innovatoren der nächsten Zeit. Und diese sind unsere Zukunft. Die Studierenden, die hier im Wettbewerb stehen, sprechen fließend Englisch, arbeiten global vernetzt und ungeachtet kultureller Unterschiede. Berührungsängste gibt es nicht und es wird sich partnerschaftlich über alle Grenzen hinweg gegenseitig unterstützt. All das ist es was Gesellschaft und Industrie von Ihren zukünftigen Fach- und Führungskräften erwarten. Bei der Formula Student Germany finden Sie es jetzt schon. Und das Aufregendste daran: Mit der FSG haben Sie die Möglichkeit, mit mehr als 2500 Vertretern der Zukunft zu sprechen, wenn Sie wollen in über 20 verschiedenen Sprachen.

Bei der Formula Student Germany versammeln sich die Ingenieure und Innovatoren der Zukunft. Tauchen Sie ein und sehen, erleben, erfahren Sie die Zukunft selbst.

Willkommen bei der Formula Student Germany 2011.

Dr. Ludwig Vollrath (VDI e.V.)
Tim Hannig (FSG e.V.)
und das Formula Student Germany Team

Dr. Ludwig Vollrath (VDI e.V.), Tim Hannig (FSG e.V.)

Personalities wanted.
Act goal-oriented.
More than 30 years ago I started at MAN as a young engineer in the field of developing innovative traffic systems. I had previously worked in research at a university and was burning to put my ideas into practice. With competence and persistence I was able to convince older and more experienced colleagues that my ideas were good. My stubbornness paid off: today I manage the central Research and Development department with a team of eighty. Just as we did then, we face the challenge of tackling issues that are relevant to the future, so that in ten years from now we will still be ahead of our competitors. The development of the hybrid bus, for example, started here in my department over 15 years ago. Now the bus is ready for the market.
If you have the will to do it, you can realise your ideas. Everything we develop has a concrete practical goal.
Eberhard Hipp,
Research & Development, MAN Truck & Bus
Commercial Vehicles Power Engineering www.man.eu
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CONTENTS
INHALT

Since 2010 Formula Student Germany consists of two competitions that run in parallel: Formula Student Combustion – with combustion engines – and Formula Student Electric – with electric motors. What both competitions have in common is that as a team effort, students build a single seated formula-style race-car with which they compete against teams from all over the world. The competition, however, is not simply won by the team with the fastest car, but rather by the team with the best overall package of design, race performance, cost management and sales planning. To succeed in this, interdisciplinary teamwork and an efficient team structure in particular are crucial.

The Formula Student competitions complement the students' practical education by incorporation of a challenging and intensive experience in designing and manufacturing as well as considering the economic aspects of automotive engineering in their studies. For the competition, the teams have to assume that they are contracted by a manufacturer to develop a race-car prototype to be evaluated for series production. The target customer group is the non-professional weekend-racer, for whom the race-car must offer very good driving characteristics regarding to acceleration, braking and handling. Furthermore, it should be offered at a reasonable price and be reliable as well as dependable. Additionally, the car's market value increases due to other factors such as aesthetics, ergonomics and the use of available standard purchase components.

The competition

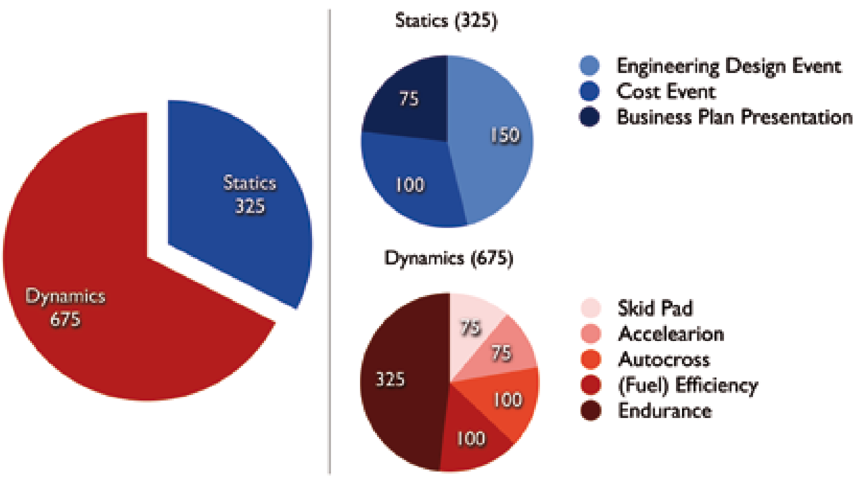
The challenge the teams face is to construct and build a prototype that best matches these given criteria. To determine the best car, a jury of experts from the motorsport, automotive and supplier industries judge every design, cost planning and business plan in comparison to the other competing teams. Furthermore, the performance on the racetrack is decisive; here the students' self-built single-seaters' prove how well they hold up under real-life conditions in a number of different disciplines.

Seit dem Jahr 2010 gibt es bei der Formula Student Germany zwei Wettbewerbe, die parallel zueinander stattfinden: die Formula Student Combustion – mit Verbrennungsmotoren - und die Formula Student Electric – mit Elektromotoren. Beiden ist gemeinsam, dass Studenten in Teamarbeit einen einsitzigen Formelrennwagen bauen, mit dem sie beim Wettbewerb gegen Teams aus der ganzen Welt antreten. Doch gewinnt nicht unbedingt das schnellste Auto, sondern das Team mit dem besten Gesamtpaket aus Konstruktion, Rennperformance, Finanzplanung und Verkaufsargumenten. Hierzu sind insbesondere interdisziplinäres Teamwork und eine effiziente Teamstruktur von großer Bedeutung.

Die Formula Student Wettbewerbe ergänzen das Studium praktisch um herausfordernde und intensive Erfahrungen mit Konstruktion und Fertigung sowie den wirtschaftlichen Aspekten des Automobilbaus. Im Sinne dieser Zielsetzung sollen die Studenten in Vorbereitung auf den Wettbewerb annehmen, eine Produktionsfirma habe sie engagiert, um einen Prototypen eines Rennwagens zur Evaluation herzustellen. Zielgruppe ist der nicht-professionelle Wochenendrennfahrer, für den der Rennwagenunter anderem sehr gute Fahreigenschaften hinsichtlich Beschleunigung, Bremskraft und Handling aufweisen muss, zusätzlich sollte das Fahrzeug wenig kosten sowie zuverlässig und einfach zu betreiben sein. Weiterhin wird sein Marktwert durch andere Faktoren wie Ästhetik, Ergonomie und den Einsatz üblicher Serienteile gesteigert.

Der Wettbewerb

Die Herausforderung für die Teams besteht darin, einen Prototypen zu konstruieren und zu bauen, der diesen Anforderungen am besten entspricht. Zur Bestimmung des Gewinnerfahrzeugs bewertet eine Jury aus Experten der Motorsport-, Automobil- und Zulieferindustrie jede Konstruktion, jeden Kostenplan und jede Verkaufspräsentation im Vergleich zu den konkurrierenden Teams. Zusätzliche beweisen die Studenten auf der Rennstrecke in unterschiedlichen Disziplinen, wie sich ihre selbstgebauten Monoposti in der Praxis bewähren.



With different disciplines the competition reflects all aspects which have to be kept in mind when constructing and building a car.
Der Wettbewerb spiegelt mit seinen verschiedenen Disziplinen alle Aspekte wider, die bei Konstruktion und Bau eines Fahrzeugs bedacht werden müssen.

THE DISCIPLINES AT A GLANCE
DIE DISZIPLINEN IM ÜBERBLICK

Altogether, there are eight disciplines. Of these, three are static in which the teams and their cars are judged based on reports, discussions and presentations. The other five disciplines are called dynamic disciplines involving a moving car and thus evaluating different performance aspects of the car.

The static disciplines

During the three static disciplines the students present their design, cost planning and business plan. These are discussed with a jury of experts from motorsports, automotive and supplier industries.

Engineering Design: In the Design Report the students set their constructive solutions and the resulting advantages out in writing. Eight pages of text and technical drawings have to convince the judges of the construction of the car and its qualities for the sales market of the non-professional weekend autocross driver. At the competition the judges examine the constructive solutions and discuss them with the students. The scoring regards the written report, the answers in the discussion and the inspection of the car.

Cost Analysis: Costs are an important factor in building a race car. Hence, the students have to deal with cost estimations, different manufacturing techniques and processes in the Cost Event. The discipline consists of a written report (the cost report) and a discussion with the judges around the manufactured prototype. The cost report contains a list of all components of the car: from wheels to process labour costs for special tooling. The judging comprises the organisation of the cost report, the comprehension of manufacturing processes and the price as well as the performance of a real case task for reducing costs.

Business Plan Presentation: The teams present their business plans for the built prototype to an assumed manufacturer - represented by the judges. The goal is to convince the judges that their car meets the demands of the target group of the non-professional weekend autocross driver best and that it can be produced and marketed profitably. Usually, one or two members of the team give a presentation for ten minutes and answer the judges' questions for an additional five minutes. Content, structure, organisation and performance of the talk are judged as well as the answers the students give.

Insgesamt gibt es acht Disziplinen. In drei der Disziplinen werden die Teams und ihre Autos in Präsentationen und Diskussionen bewertet. Dies sind die statischen Disziplinen. Die anderen fünf Diziplinen sind dynamisch und bewerten verschiedene Aspekte des fahrenden Autos.

Statische Disziplinen

In den drei statischen Disziplinen präsentieren die Studenten ihre Konstruktionen, ihre Kostenplanung und ihr Geschäftsmodell. Diese werden mit einer Jury aus Experten der Motorsport-, Automobil- und Zulieferindustrie diskutiert.

Engineering Design: Im Design Report dokumentieren die studentischen Konstrukteure ihre konstruktiven Lösungen und deren Vorteile. Acht Seiten Text und technische Zeichnungen sollen die Juroren von den Konstruktionen und ihren Vorzügen für die Zielgruppe des nicht-professionellen Wochenendrennfahrers überzeugen. Beim Wettbewerb werden die Konstruktionen von den Juroren am Fahrzeug begutachtet und mit den Studenten diskutiert. Die Bewertung erfolgt anhand des Design Reports, der Antworten in der Diskussion und der Begutachtung des Fahrzeugs.

Cost Analysis: Die Kosten sind für den Bau eines Rennwagens ein entscheidender Faktor. Beim Cost Event beschäftigen sich die Studenten mit Kalkulation, Fertigungstechniken und -prozessen. Die Disziplin besteht aus einem schriftlichen Bericht (dem Cost Report) und einer Diskussion mit den Juroren am gebauten Prototypen. Der Cost Report enthält eine Auflistung aller Teile: vom Reifen bis zu den Herstellungskosten für Spezialwerkzeuge. Bewertet wird die Aufbereitung des Cost Reports, das Verstehen von Fertigungsverfahren zur Kostenoptimierung, der Preis sowie die Lösung einer Real Case Aufgabe zur Kostenreduktion.

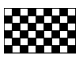
Business Plan Presentation: Die Teams stellen einer fiktiven Herstellerfirma, vertreten durch die Juroren, ihren Geschäftsplan für den gebauten Prototypen vor. Mit diesem wollen sie die Juroren davon überzeugen, dass ihr Fahrzeug am besten die Anforderungen der Zielgruppe, des nicht-professionellen Wochenendrennfahrers, erfüllt und gewinnbringend produziert und vermarktet werden kann. Die Präsentation der Teams dauert zehn Minuten, gefolgt von einer fünfminütigen Frage- und Diskussionsrunde mit den Juroren. Bewertet werden Inhalt, Aufbau, Aufbereitung und Darbietung des Vortrags sowie die Antworten des Teams auf Fragen.

At the competition Cost and Design Judges take a closer look at the prototype and discuss the solutions with the students. Both events are based on written reports. However, the Business Plan is presented and closes with questions from the judges.
Beim Wettbewerb betrachten die Cost und die Design Juroren die Prototypen genau und diskutieren die Lösungen mit den Studenten. Beide Events basieren auf schriftlichen Berichten. Dagegen der Geschäftsplan präsentiert und endet mit Fragen der Juroren.



Flags
Flaggen

Your session has started, enter the course!
Deine Fahrt beginnt. Fahr auf die Strecke!



Your session has been completed. Exit the course!
Deine Fahrt ist beendet. Verlass die Strecke!

Dynamic disciplines

During the dynamic disciplines the cars have to prove the performance capabilities of the students' design on the race track. The disciplines demand different qualities of the car. In each discipline two drivers have two runs (except in the Endurance Event). The best run of the four will be counted as the optimum the car can achieve.

Acceleration: The race cars prove their accelerating abilities over a distance of 75 meters from a standing start. The fastest cars cover the distance in less than 4 seconds and achieve a maximum velocity of more than 100km/h.

Skid Pad: The student-built cars drive on a course in the shape of an eight. Two consecutive laps on each circle are driven, with the second lap being timed. The cars demonstrate the steady-state lateral acceleration they can generate. This year for the first time at FSG, the Skid Pad will be carried out on a continuously watered surface ("Wet Pad") to make sure the conditions are constant for all teams.

Autocross: The cars drive on a course of perhaps one kilometre through straights and turns, chicanes and slaloms. The lap time serves as an indicator for driving dynamics and handling qualities. The results of the Autocross discipline also determine the starting order in the Endurance.

Endurance: Providing the highest number of points, the Endurance is the main discipline. Over the course of 22 kilometres the cars have to prove their durability under long-term conditions. Acceleration, speed, handling, dynamics, fuel efficiency and most importantly the reliability of the cars are put to their limits. The Endurance also demands handling skills of the driver as the course can only be "walked" in preparation. Up to four cars are allowed on the track at the same time. Each team has only one attempt, the drivers change after 11 kilometres.

Fuel / Energy Efficiency:
During the Endurance the fuel consumption (FSC) / energy consumption (FSE) is measured. The points' calculation does not only evaluate fuel / energy consumption, but puts it in relation to speed. The calculation is based on an average per completed lap which also enables an evaluation of teams that did not finish. However, to be evaluated and to get points the driver change has to have been completed.

Dynamische Disziplinen

In den dynamischen Disziplinen müssen die Fahrzeuge die Praxistauglichkeit der studentischen Konstruktionen auf der Rennstrecke unter Beweis stellen. Mit jeder Disziplin werden unterschiedliche Eigenschaften des Autos getestet. Grundsätzlich starten zwei Fahrer mit je zwei Versuchen (außer im Endurance-Rennen). Gewertet wird der jeweils beste Versuch als das Optimum, das das Fahrzeug erzielen kann.

Acceleration: Auf einer 75 Meter langen Geraden müssen die Rennwagen beweisen, wie schnell sie aus dem Stand beschleunigen können. Die Besten bewältigen die Strecke in einer Zeit von unter vier Sekunden und erreichen dabei eine maximal Geschwindigkeit von mehr als 100km/h.

Skid Pad: Die selbstgebauten Rennwagen durchfahren einen Parcours in Form einer Acht. Jeder Kreisring wird zweimal nacheinander umrundet, gemessen wird jeweils die zweite Runde. Die Rundenzeit zeigt, welche statische Querbeschleunigung das Fahrzeug erreichen kann. In diesem Jahr wird bei der FSG das Skid Pad zum ersten Mal auf einer kontinuierlich bewässerten Oberfläche gefahren („Wet Pad"), um sicherzustellen, dass die Bedingungen für alle Teams die gleichen sind.

Autocross: Über eine etwa 1 Kilometer lange Runde fahren die Rennwagen durch Geraden, Kurven und Schikanen. Eine schnelle Rundenzeit ist sowohl ein Indikator für eine gute Fahrdynamik als auch für gute Handling- und Beschleunigungseigenschaften. Die Platzierung im Autocross entscheidet zudem über die Startreihenfolge in der Endurance-Disziplin.

Endurance: Das Endurance-Rennen stellt mit der höchsten erreichbaren Punktzahl die Hauptdisziplin dar. Über eine Renndistanz von 22 Kilometern muss sich die Gesamtkonstruktion unter Dauerbelastung beweisen. Hier sind alle Eigenschaften von der Beschleunigung bis hin zu Handling und Fahrdynamik gefragt. Das Endurance-Rennen erfordert auch besonderes Renngeschick des Fahrers, da die Strecke als Vorbereitung nur abgeschritten werden darf. Während des Rennens sind bis zu vier Fahrzeuge gleichzeitig auf der Strecke. Jedes Team hat einen einzigen Versuch, die Fahrer wechseln nach 11 Kilometern.

Fuel / Energy Efficiency:
Während des Endurance-Rennens wird der Kraftstoffverbrauch (FSC Fahrzeuge) / Energieverbrauch (FSE Fahrzeuge) gemessen. Bei der Berechnung der erreichten Punkte, zählt nicht einfach der Verbrauch, sondern vielmehr der Verbrauch in Relation zur Geschwindigkeit. Neu ist dabei außerdem die Rechnung mit Durchschnittswerten pro gefahrener Runde, die auch die Bewertung von Teams ermöglicht, die nicht das Ziel erreichen. Der Fahrerwechsel muss allerdings erfolgt sein.

Pull into the passing zone to be passed by a faster competitor!
Fahr in der Überholzone, damit ein schnelleres Fahrzeug überholen kann!

Pull into the penalty box for a mechanical inspection of your car!
Fahr in die Kontrollzone für eine Untersuchung des Fahrzeugs!

Pull into the penalty box for discussion concerning an incident that may cause a time penalty!
Fahr in die Kontrollzone zur Diskussion eines Vorfalls! Ggf. Zeitstrafe!

Come to an immediate safe controlled stop on the course! Pull to the side of the course.
Komm sofort kontrolliert zum Stehen. Halte die Strecke frei.

Something is on the track that should not be there. Be prepared for evasive maneuvers to avoid debris or liquids!
Es ist etwas Unerwartetes auf der Strecke. Sei bereit Flüssigkeiten oder Bruchstücken auszuweichen!

Something has happened beyond the flag station. No passing unless directed by the track marshals. Stationary: Danger! Slow down, be prepared to take evasive action. Waved: Great Danger! Slow down, evasive action is most likely required, be prepared to stop.
Etwas ist jenseits der Flagge passiert.Fahr nicht vorbei ohne Anweisung der Streckenposten. Feststehend: Gefahr! Fahr langsam, sei bereit zum Ausweichen. Geschwenkt: Große Gefahr! Fahr langsam, Ausweichen wird erforderlich sein. Sei bereit anzuhalten.

There is a slow moving vehicle on the course. Be prepared to approach it at a cautious rate.
Es ist ein langsames Fahrzeug auf der Strecke. Nähere dich vorsichtig an.

Abschlussarbeiten, Praktikanten, Absolventen w|m

für die Bereiche Applikation, Funktionsentwicklung, Softwareentwicklung, Systementwicklung und Hardwareentwicklung

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Jeder Erfolg hat seinen Anfang. Bewerben Sie sich jetzt online unter www.bosch-engineering.de. Für Fragen steht Ihnen Frau Claudia Deckert unter der Nummer 07062 911-7200 gerne zur Verfügung.

www.bosch-engineering.de

Bachelor und Master:
Herzlich willkommen!

Formula Student Germany

Best Use of Adhesives Award
powered by Henkel

Best Lightweight Concept Award
powered by AUDI AG

Best Prepared Car for Scrutineering
powered by DEKRA Automobile GmbH

FSG Sportsmanship Award
presented by FSG Executive Committee

FSG Media Award
powered by FSG Communication Team

Formula Student Combustion

- Formula Student Combustion Champion
- Formula Student Combustion – 2nd
- Formula Student Combustion – 3rd
- FSC Engineering Design Award – 1st
- FSC Engineering Design Award – 2nd
- FSC Engineering Design Award – 3rd
- FSC Cost Analysis Award – 1st
- FSC Cost Analysis Award – 2nd
- FSC Cost Analysis Award – 3rd
- FSC Business Plan Presentation Award – 1st
- FSC Business Plan Presentation Award – 2nd
- FSC Business Plan Presentation Award – 3rd
- FSC Endurance Winner
- FSC Acceleration Winner
- FSC Skid Pad Winner
- FSC Autocross Winner
- FSC 1st Place Overall Dynamic Events
  powered by VDI e.V.
- Most Fuel Efficient Car
  powered by Kautex
- Most Effective Use of Electronics Award
  powered by Bosch Engineering GmbH
- Most Innovative Powertrain Award
  powered by Tognum AG

Formula Student Electric

- Formula Student Electric Champion
- Formula Student Electric – 2nd
- Formula Student Electric – 3rd
- FSE Engineering Design Award – 1st
- FSE Engineering Design Award – 2nd
- FSE Engineering Design Award – 3rd
- FSE Cost Analysis Award – 1st
- FSE Cost Analysis Award – 2nd
- FSE Cost Analysis Award – 3rd
- FSE Business Plan Presentation Award – 1st
- FSE Business Plan Presentation Award – 2nd
- FSE Business Plan Presentation Award – 3rd
- FSE Endurance Winner
- FSE Acceleration Winner
- FSE Skid Pad Winner
- FSE Autocross Winner
- FSE 1st place Overall Dynamic Events
  powered by VDI e.V.
- Most Energy Efficient Car
  powered by HARTING
- Best E-Drive Packaging Award
  powered by Daimler AG
- Best Energy Management Award
  powered by Bosch Engineering GmbH
- Best Project Planning
  presented by Formula Student Academy


We're driven by performance.
And what drives you?

SCHEDULE 2011
ZEITPLAN 2011

TUESDAY, 2ND OF AUGUST 2011

14:00	Scrutineering, Registration & Entrance Order Available	1 Ticket Center
16:00 – 18:00	FSC & FSE Team Registration	1 Ticket Center
18:00 – Sun 20:00	FSC & FSE Pits Available	4 19 Pits
18:00 – 20:00	Event Control, Driver & Safety Responsible Registration	2 Event Control
18:00 – 23:00	Entrance for Team Vehicles (pits are still accesible by foot)	

WEDNESDAY, 3RD OF AUGUST 2011

07:30 – 19:00	Ticket Center & Event Control	1 2 Ticket Center / Event Control
09:00 – 19:00	Scrutineering / Tech Inspection	9
13:00 – 14:00	Lunch Break & Staging for Panoramic Photograph	17 Big Dynamic Area
14:00 – 19:00	Tilt, Rain, Brake, Noise	10 11 12
14:00 – 19:00	Fuel / Testing / Engine Test	17 Big Dynamic Area
20:00 – 21:00	Team Welcome	5 Marquee Above Pits

THURSDAY, 4TH OF AUGUST 2011

07:30 – 19:00	Ticket Center & Event Control	1 2 Ticket Center / Event Control
08:00 – 08:30	Team Briefing	5 Marquee Above Pits
08:30 – 19:00	Scrutineering / Tech Inspection / Tilt, Rain, Brake, Noise	9 10 11 12
12:00 – 13:00	Scrutineering Lunch Break	
09:00 – 19:00	Fuel / Engine Test / Testing	17 Big Dynamic Area
11:00 – 12:30	Judge Briefing: Business Plan, Cost & Design	7 BW Tower
13:30 – 18:10	FSE Engineering Design & FSE Cost Analysis	5 Marquee Above Pits
13:30 – 18:10	FSE Business Plan Presentation	7 BW Tower, Mobil-Tower
18:30 – 20:00	FSE Business Plan Presentation Finals	5 Marquee Above Pits
18:30 – 20:00	Judge Briefing: Cost & Design	7 BW Tower
20:00 – 21:00	Reception for Faculty Advisors, Team Captains & Judges powered by BOSCH	3 FSG Forum

FRIDAY, 5TH OF AUGUST 2011

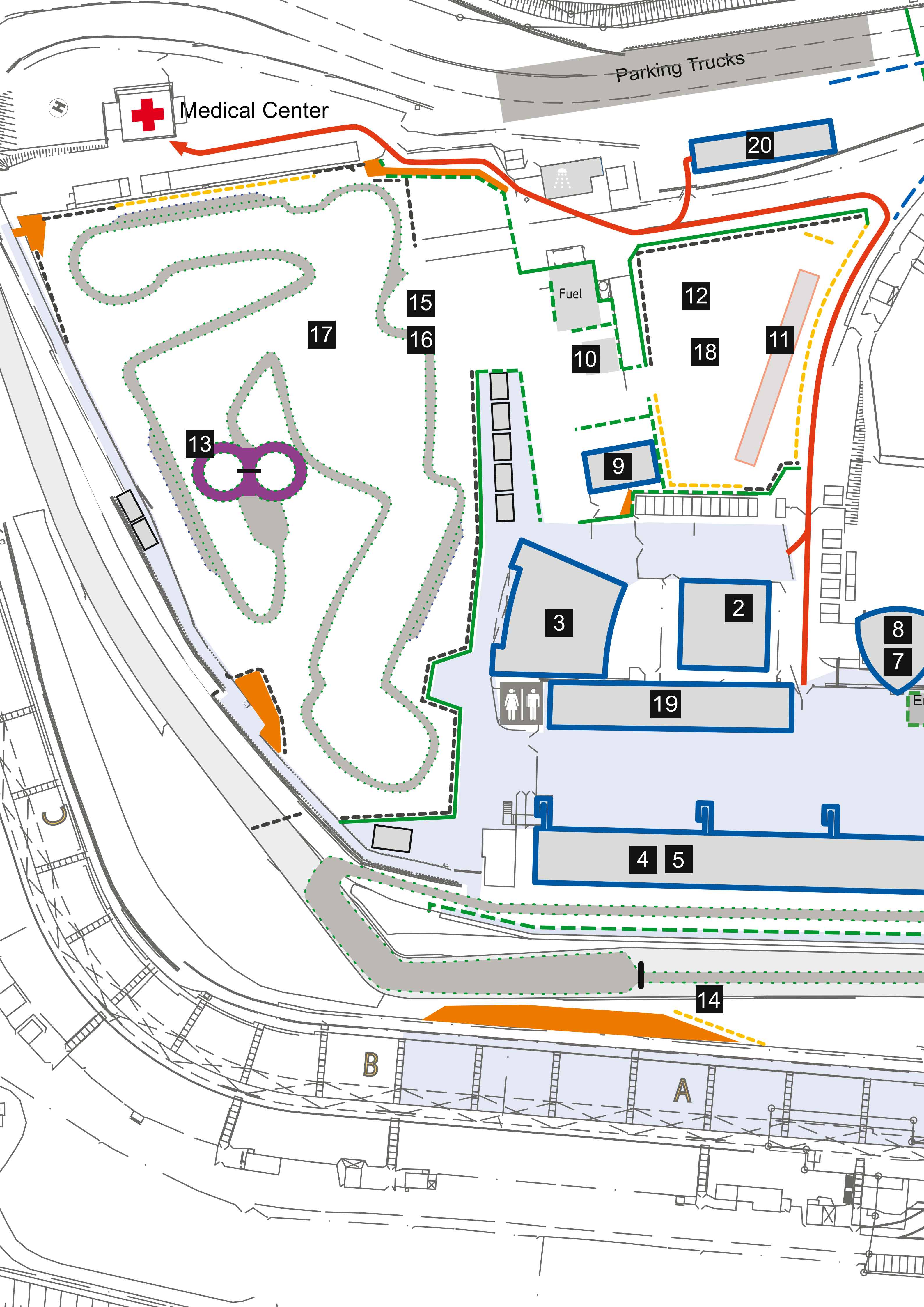
07:30 – 19:00	Ticket Center & Event Control	1 2 Ticket Center / Event Control
08:00 – 08:30	Team Briefing	5 Marquee Above Pits
08:00 – 08:45	Judge Briefing: Business Plan Presentation	7 BW Tower
08:30 – 19:00	Scrutineering / Tech Inspection / Tilt, Brake, Noise, Rain	9 10 11 12
12:00 – 13:00	Scrutineering Lunch Break	
09:00 – 19:00	Fuel / Engine Test / Testing	17 Big Dynamic Area
11:00 – 18:30	Skid Pad	13 Dynamic Area
09:00 – 18:40	FSC Engineering Design, FSC Cost Analysis FSC Business Plan Presentation	5 Marquee Above Pits 7 BW Tower, Mobil-Tower
19:00 – 20:30	FSE Engineering Design Finals	3 FSG Forum, not public
20:00 – 21:00	FSC Business Plan Presentation Finals	5 Marquee Above Pits
21:00 – 22:00	Award Ceremony - Part I	5 Marquee Above Pits
22:00 – 23:00	Get-Together for all Judges & Redshirts	8 BW Tower

SATURDAY, 6TH OF AUGUST 2011

07:30 – 22:00	Ticket Center & Event Control	1 2 Ticket Center / Event Control
08:00 – 08:30	Team Briefing	5 Marquee Above Pits
08:30 – 18:30	Fuel / Engine Test / Testing	18 Small Dynamic Area
08:30 – 09:00	Coursewalk Autocross	15 Dynamic Area
09:00 – 14:00	FSC & FSE Acceleration	14 Start/Finish Line
10:00 – 17:00	FSC & FSE Autocross	15 Dynamic Area
11:30 – 14:30	Press & VIP Reception & Guided Tours	8 BW Tower
19:00 – 21:30	FSC Engineering Design Finals	3 FSG Forum, not public
21:30 – 22:00	Coursewalk FSE Endurance	16 Dynamic Area
22:00 – 01:00	FSE Endurance & Parc Fermé	16 Dynamic Area

SUNDAY, 7TH OF AUGUST 2011

07:30 – 19:00	Ticket Center & Event Control	1 2 Ticket Center / Event Control
07:30 – 08:00	Team Briefing	5 Marquee Above Pits
08:00 – 08:30	Coursewalk FSC Endurance	16 Dynamic Area
08:30 – 18:30	Fuel / Engine Test / Testing	18 Small Dynamic Area
08:30 – 12:30	FSC Endurance Morning Session & Parc Fermé	16 Dynamic Area
13:00 – 18:00	FSC Endurance Afternoon Session & Parc Fermé	16 Dynamic Area
19:30 – 20:30	Design Review	3 FSG Forum
21:00 – 22:00	Awards Ceremony	5 Marquee Above Pits
22:00 – 01:00	MAHLE-Party	5 Marquee Above Pits



Medical Center
Parking Trucks
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Fuel
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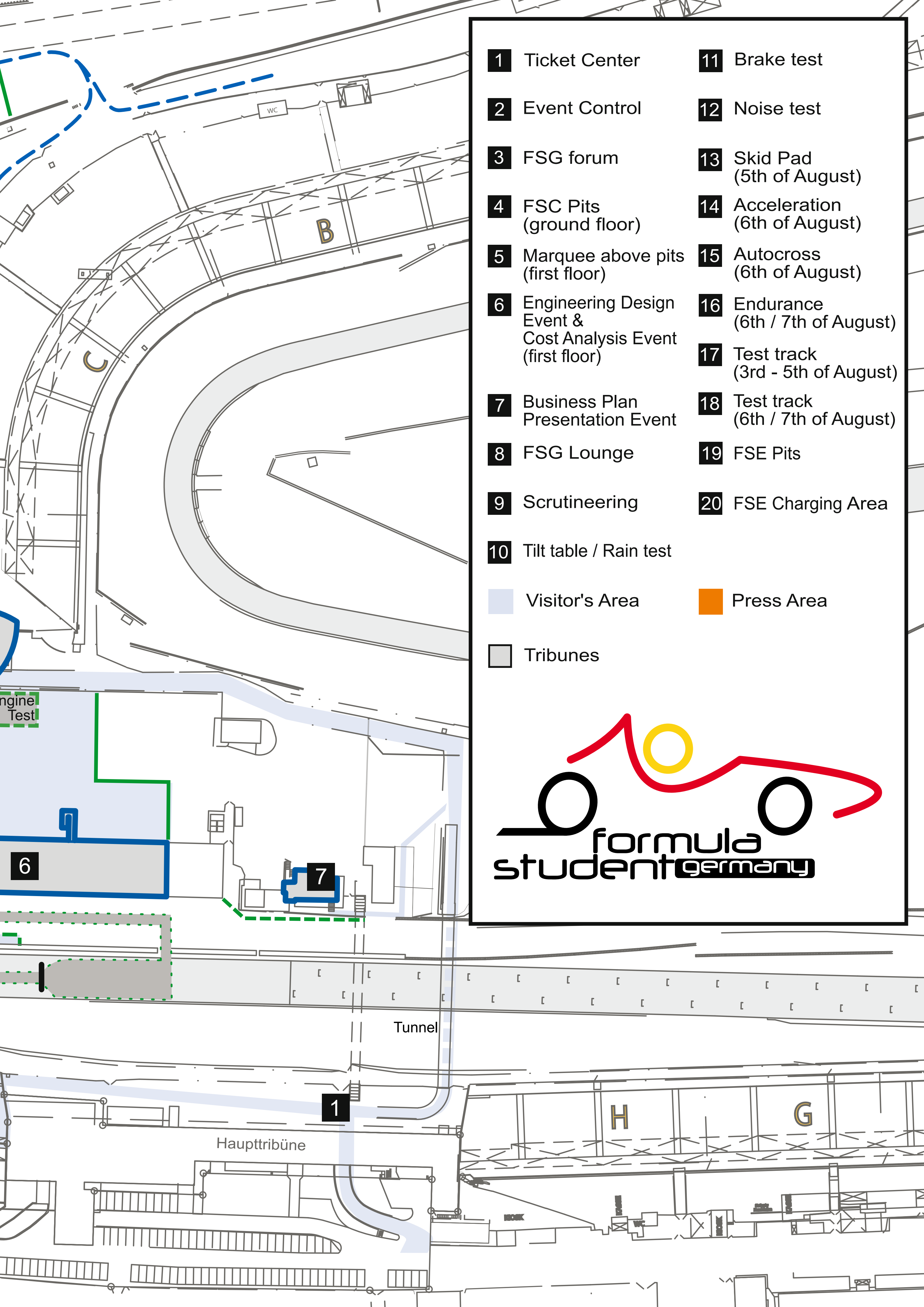
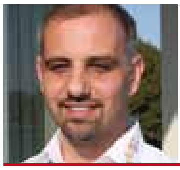

1 Ticket Center
2 Event Control
3 FSG forum
4 FSC Pits (ground floor)
5 Marquee above pits (first floor)
6 Engineering Design Event & Cost Analysis Event (first floor)
7 Business Plan Presentation Event
8 FSG Lounge
9 Scrutineering
10 Tilt table / Rain test
11 Brake test
12 Noise test
13 Skid Pad (5th of August)
14 Acceleration (6th of August)
15 Autocross (6th of August)
16 Endurance (6th / 7th of August)
17 Test track (3rd - 5th of August)
18 Test track (6th / 7th of August)
19 FSE Pits
20 FSE Charging Area
Visitor's Area
Press Area
Tribunes
formula student germany
B
C
ngine Test
6
7
Tunnel
1
Haupttribüne
H
G

FORMULA STUDENT GERMANY TEAM

Tim Hannig
Board (Chairmen)
Linde (China)

Ludwig Vollrath
Board (FS Academy & VDI)
VDI Society for Automotive and Traffic Systems Technology



Lukas Folie
EC (FS-Electric)
Audi AG

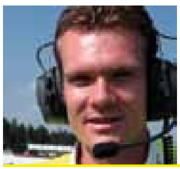
Barbara Decker-Schlögl
EC (Statics)
Mubea Carbo Tech GmbH

Ann-Christin Bartölke
Communications / Guided Tours
Braunschweig Institute of Technology

Leona Ehrenreich
Registration,Visa, Ticket Center
Primary and Secondary Modern School Freiherr-vom-Stein, Gifhorn

Wolf-Bastian Pöttner
Timekeeping
Braunschweig Institute of Technology

André Schmidt
Scrutineering
Caterpillar Inc.



Karsten Stammen
Dynamics
KLK Motorsport GmbH

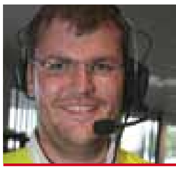
Christopher Zinke
Design Event
Elektronische Fahrwerkssysteme GmbH

Rainer Kötke
Board (Finance)
EC (Dynamics)
Volkswagen AG

Board

The Board is responsible for the Formula Student Germany and its cooperations as well as for sponsoring, finances and strategy.

Das Board trägt Verantwortung für die Formula Student Germany und ihre Kooperationen sowie für Sponsoring, Finanzen und Strategie.



Peter Jakowski
EC (Scoring, Timekeeping)
Bosch Engineering GmbH

Ulf Steinfurth
EC (Technical Inspection)
University of Applied Sciences Stralsund

Matthias Brutschin
Event Support
brutschin engineering

Robert Fromholz
Cost Event
H&D International Group

Günther Riedl
Dynamics
Roding Automobile GmbH

Jochen Schmidt
Timekeeping
German Aerospace Center (DLR)

Lena Töppich
Communications (Press)
VDI Verein Deutscher Ingenieure e.V.

Operative Team

The Operative Team completes the management team by bearing responsibility for preparations and smooth processes at the event and during the year.

Das Operative Team komplettiert das Management Team, indem es beim Event und übers Jahr Verantwortung für Vorbereitung und reibungslosen Ablauf übernimmt.

Daniel Mazur
Board (Event Manager)
mazur | events + media

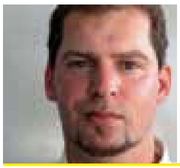
Julien van Campen
EC (Communication)
OT (Webmaster)

Tobias Michaels
EC (FS-Electric)
Braunschweig Institute of Technology

Executive Committee (EC)

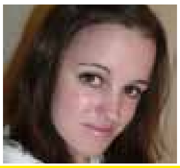
The Executive Committee stands for the design of the competition and the rules. Each member is responsible for a field, its preparation and realisation.

Das Executive Committee verantwortet Ausgestaltung von Wettbewerb und Reglement. Jedes Mitglied ist für Vorbereitung und Durchführung eines Bereiches verantwortlich.



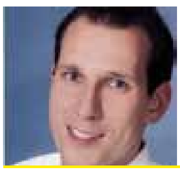
Daniel Deussen
Dynamics, Scrutineering
Weber Motor GmbH

Henning Nissen
Communications / Guided Tours
Beuth Hochschule für Technik



Sarah Roloff
Communications / Marquee
Eurocopter Deutschland GmbH

Tim Schmidt
Event Control (Back Office)



Karl Weinreich
Scrutineering
Bosch Engineering GmbH

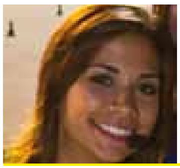
Frank Röske
Board (Rules)
EC (Rules IC)
Porsche Leipzig GmbH

Matthäus Decker
EC (Personnel Support)
Siemens AG Österreich

Konrad Paule
EC (FS-Academy)
OT (Pit Marshal)
Volkswagen Motorsport GmbH

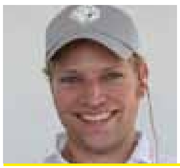
Daniel Ahrens
Event Control
Aegis Media Central Europe

Cas Droogendijk
Design Event
DAF Trucks N.V.

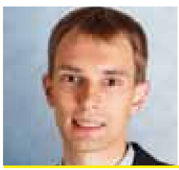


Alia Pierce
Communications / Event Speaker

Johanna Scheider
Communications (FSG Forum / Editor)
Wickeder Westfalenstahl GmbH



Sebastian Seewaldt
Pit Marshal
University of Stuttgart



Stefan Windt
Timekeeping
Volkswagen AG

Engineering Design

Engineering Design Judges 2010

Ahola, Mikko	Artline Engineering OY
Aichberger, Marcus	MAN Truck & Bus AG
Albrecht, Sven	Volkswagen AG
Ballenger, James	Ballenger Motorsports, Inc.
Balnus, Christian	AUDI AG
Bayer, Bernward	Continental AG
Beck, Markus	Bosch Engineering GmbH
Binnwerk, Wolfgang	MAN Truck & Bus AG
Borchardt, Jan	Caterpillar Motoren GmbH & Co.KG
Bremkamp, Joerg	Daimler AG
Carless, Owen	Red Bull Technology
Clarke, Pat	Hyundai Australia
Daman, Paul	BMW AG
Daniel, Frank	Adam Opel AG
Daniel, Marc	AUDI AG
Deckers, Jean-Noel	TR Engineering powered by IAV
Diebold, Rainer	2D Debus & Diebold Meßsysteme GmbH
Dittrich, Rudolf	BMW Motorsport
Dölle, Norbert	Daimler AG
Domann, Nils	TU Braunschweig
Echter, Franz-Xaver	MAN Truck & Bus AG
Enning, Norbert	Audi AG
Ewert, Sebastian	MAHLE GmbH
Fehr, Florian	BMW Group
Fox, Steven	PowerTrain Technology, Inc.
Fries, Benedikt	Audi AG
Frommer, Armin	MAHLE GmbH
Galganski, Collin	HUSCO Automotive
Gamen Franco, Irache	Daimler AG
Gehrig, Horst	Bosch Engineering GmbH
Gerth, Henrik	IAV GmbH
Gesele, Frank	Audi AG
Goddard, Geoffrey	oxford brookes university
Gore, Doug	Gore Engineering
Gould, David	Gould Engineering
Graf, Michael	TU Munich
Hanigk, Martin	BMW AG
Himmler, Florian	Drott Holding
Hoffmann, Jürgen	Volkswagen AG
Hölzgen, André	euro engineering AG
Huhn, Werner	Porsche AG
Kamath, Vinayak	BMW Group
Kerber, Michael	Audi AG
Kerscher, Alexander	BMW M
Klaus, Hartmut	HARTING Electronics GmbH & Co. KG
Knecht, Stefan	MAN Truck & Bus AG
Knipp, Christian	AUDI AG
Körsten, Michael	MAN Truck & Bus AG
Kossel, Joshua	Renewegy
Krappel, Michael	MAHLE International GmbH
Krueger, Markus	Caterpillar Motoren Gmbh & Co. KG
Kwiatkowski, Adam	General Motors
Ladda, Josefine	Robert Bosch GmbH
Lambert, Richard	Lockheed Martin UK
Laue, Tino	Volkswagen AG
Loehr, Wikhart	IAV GmbH
Löser, Stefan	MAN Truck & Bus AG
Lück, Peter	Volkswagen AG
Maas, Gerhard	IAV GmbH
Martin, Felipe	Aries Ingeniería
Maschke, Yves	Volkswagen AG
McLean, Brian	BMW AG
Milke, Burkhard	Adam Opel AG
Missler, Christian	Continental AG
Mohra, Holger	MAN Truck & Bus AG
Müller, Karsten	IAV GmbH
Nowicki, Daniel	BMW AG
Pälmer, Oliver	Daimler AG
Peti, Philipp	Adam Opel AG
Petz, Andreas	Audi AG
Pöttner, Jost Philip	H&D IT Automotive Services GmbH
Prehl, Christoph	Bosch Engineering GmbH
Reetz, Volker	MAN Truck & Bus AG
Rieke, Johannes	Fraunhofer
Riley, William	General Motors
Rittler, Armin	BMW
Rohlmann, Christoph	Daimler AG
Rouelle, Claude	OptimumG LLC
Sachse, Mick	Donnersbergschmiede
Sander, Udo	MTU Friedrichshafen GmbH
Schäffler, Klaus	BMW AG
Schiele, Peter	BMW AG
Schmidt, Jochen	DLR
Schmidt, Ralf	BMW Motorrad
Schnee, Ralf	Bosch Engineering GmbH
Schneider, Thomas	Volkswagen AG
Scigalla, Philipp	MAN Truck & Bus AG
Send, Markus	Toyota Motorsport GmbH
Simonian, Samo	TU Delft
Soens, Andreas	Daimler
Spoida, Thomas	Daimler AG
Stammen, Karsten	KLK Motorsport GmbH
Stange, Michael	ThyssenKrupp Presta München/ Esslingen GmbH
Strasser, Roman	Audi AG
Sturm, Michael	Universität der Bundeswehr
Tesch, Anke Martina	Volkswagen AG
Underberg, Victor	AUDI AG
Veyseh, Haman	Daimler Protics GmbH
Völkl, Timo	AUDI AG
Weiss, Johannes	Daimler AG
Wunschheim, Lukas	Adam Opel GmbH

Business Plan Presentation


Business Plan Presentation Judges 2010

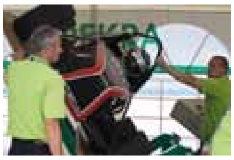
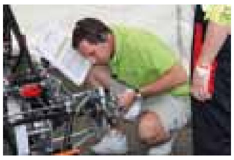
Badmann, Andre	MAHLE International GmbH
Behrendt, Peter	Volkswagen AG
Berg, Alexander	DEKRA Automobil GmbH
Bertram, Michael	BMW Group
Bienert, Margo A.	Georg Simon Ohm Hochschule Nürnberg
Boehm, Dirk-Rene	Robert Bosch GmbH
Eckhardt, Markus	Brunel GmbH
Esser, Klaus	Kautex Textron
Fees, Wolfram	Brunel GmbH
Fichtl, Katrin	ZF Friedrichshafen AG
Frank, Detlef	
Harm, Christian	KION Group GmbH
Heinrich, Olaf	DekaBank
Herrmann, Jesko	Bertrandt AG
Hieber, Frank	Continental AG
Holz, Patrick	S. & V. Consult GmbH
Kraemer, Clemens	Tognum Group
Lange, Stephan	Accenture GmbH
Mueller, Andreas	Kautex Textron GmbH & Co KG
Niemeyer, Reinhard	Air Liquide Welding
Richter, Ralf	IAV GmbH
Schöniger, Sebastian	Volkswagen AG
Schreck, Torsten	MAN Truck & Bus AG
Sorg, Sebastian	Robert Bosch GmbH
Tabatabai, Stefan	Porsche Consulting GmbH
Teuscher, Tobias	Robert Bosch GmbH
Therond, Sebastien	Robert Bosch GmbH
Tillack, Karola	HARTING Electric
Vollrath, Hans	hawovo consult
Wolf, Alexander	Continental AG

Cost Analysis


Cost Analysis Judges 2010

Ankert, Detlef	Kautex Textron
Dietachmayr, Walter	BMW AG
Grundner, Harald	InnoVAVE - Harald Grundner
Hagl, Markus	BMW Group
Herth, Martin	Continental Automotive GmbH
Kotzian, Andreas	BMW AG
Kurzen, Michael	BMW AG
Massa, Mario	Festo AG & Co. KG
Mesic, Miroslav	Festo AG & Co. KG
Metz, Simon	Continental AG
Möll, Winfried	Dipl. Ing. W. Bender GmbH
Morel, Romain	Continental Automotive GmbH
Pälmer, Reinhard	MBtech Group GmbH & Co. KGaA
Piltzing, Roger	Continental
Scharff, Robert	
Schnabel, Matthias	D.O.K. GmbH
Steinmeier, Frank	Continental Automotive GmbH
Wigger, Tobias	Universität Siegen
Wörz, Wolf	Daimler AG

Scrutineering

Scrutineers 2010

Ambos, Ralf	DEKRA
Amend, Werner	DEKRA
Böckmann, Stefan	DEKRA
Borchardt, Toni	Bosch Engineering GmbH
Both, Michael	DEKRA
Dammert, Wolfgang	DEKRA
Domann, Nils	TU Braunschweig
Drop, Frank	Max Planck Institute
Falb, Juergen	Kube GmbH Ingenieurbüro
Goyal, Vandit	Hochschule Esslingen
Granzow, Pit	
Hallsten, Markus	AVL
Hennings, Thomas	Universität Stuttgart
Jokisch, Marius	DEKRA
Kleijn, Emil	TU/e University of Technology
Klemm, Michael	DEKRA
Klopfer, Lennert	DEKRA
Laine, Petri	VTT
Lidzba, Thomas	DEKRA
Lopez, Baltasar	
Maul, Ralf	TheSys GmbH
Müller, Winfried	Bertrand
Pohl, Wolfgang	DEKRA
Priggemeyer-Schürmann, Andreas	DEKRA
Scheifele, Christoph	DEKRA
Schmidt, Ronny	UAS Zwickau
Schmidt, Reinhold	DEKRA
Schoen, Wolfgang	ZF Friedrichshafen AG
Shetty, Keerthan	Continental AG
Speer, Lutz	DEKRA
Stahl, Martin	ZF Getriebe GmbH
Steinfurth, Ulf	FH Stralsund
Steuernagel, Peter	DEKRA
Thomassen, Kevin	
Trappmann, Gerd	DEKRA
Wagner, Günter	DEKRA
Weinreich, Karl	Bosch Engineering

Status at the time of going to press.
Status bei Redaktionsschluss

Audi

Michael Groß
Head of Personnel Marketing, AUDI AG

Formula Student Germany – five days of tinkering, technology and teamwork! We at Audi are awaiting the event at the Hockenheimring just as eagerly as the participating teams. After all, the pit lanes and race track are the perfect places to meet extremely dedicated students and get to know them where our heart beats – working on cars. The participants have exactly what we are looking for in future employees: specialist knowledge, innovative and sometimes even unconventional problem-solving approaches coupled with good teamwork and communication skills. What we share is a love of technology – of "Vorsprung durch Technik". And those who are able to put our brand values of sportiness, progressiveness and sophistication onto the race track – whether with an electric motor or a combustion engine – are a good match for Audi as well.

We look forward to an exciting event and wish all the teams every success!

Formula Student Germany – fünf Tage Tüfteln, Technik und Teamwork! Dem Event am Hockenheimring fiebern wir bei Audi mindestens genauso aufgeregt entgegen, wie die teilnehmenden Teams. Denn in der Boxengasse und auf der Rennstrecke treffen wir extrem engagierte Studenten und können sie dort kennenlernen, wo unser Herz schlägt: beim Tüfteln am Automobil. Die Teilnehmer bringen genau das mit, was wir uns von unseren zukünftigen Mitarbeitern wünschen: fachliches Wissen, innovative und manchmal auch unkonventionelle Lösungsansätze, aber auch Team- und Kommunikationsfähigkeit. Uns allen gemeinsam ist die Begeisterung für Technik – für „Vorsprung durch Technik". Und wer es schafft, unsere Markenwerte Sportlichkeit, Progressivität und Hochwertigkeit, auf die Rennstrecke zu bringen, sei es mit elektrischem oder Verbrennungsmotor, passt auch gut zu Audi.

Wir freuen uns auf ein spannendes Event und wünschen allen Teams viel Erfolg!

Autodesk

Don Carlson
Education Director, Europe, Middle-East, Africa
Autodesk

Autodesk supports students and educators by providing design software, innovative programs and other resources designed to inspire the next generation of professionals. By supporting educators to advance design education and science, technology, engineering and math (STEM) skills, Autodesk is helping prepare students for future academic and career success. Autodesk supports schools and institutions of higher learning worldwide through substantial discounts, subscriptions, grant programs, training, curriculum development and community resources.

For more information about Autodesk education programs and solutions, visit autodesk.com/education-emea.

Studenten von heute sind die Spezialisten von morgen. Autodesk unterstützt mit verschiedenen Programmen Nachwuchskräfte beim Erreichen ihrer beruflichen Ziele und bereitet sie auf ihre zukünftigen Tätigkeiten vor. Gleichzeitig können Dozenten mit dem Angebot von Autodesk die Fähigkeiten ihrer Schüler in den Fächern Gestaltung und Wissenschaft, Technik und Mathematik fördern.

Weitere Informationen zu der Autodesk Student Community unter www.autodesk.de/education.

BMW Group

Michael Albrecht
Head of HR Marketing International and Recruiting, BMW Group

It is with great pleasure that the BMW Group supports initiatives such as Formula Student which combine acquired theory with practical experience in an exemplary manner. The acquisition of skills and key expertise such as interdisciplinary thinking, problem-solving and business knowledge is realized in an exemplary fashion in this competition.
We are only too familiar with these requirements of teams from our own company. We therefore welcome applications from qualified Formula Student participants both from Germany and abroad for practical internships as well as job vacancies. We are looking for enthusiastic young engineers in various departments such as research and development who, like our own staff, enjoy being involved in innovative projects at the very highest level.

Mit großer Freude unterstützt die BMW Group die Formula Student Initiative, da sie Studenten auf einzigartige Weise die Möglichkeit gibt, theoretisches Wissen mit gelebter Praxis zu verbinden. Hier, in der praktischen Anwendung, werden mit Begeisterung Fähigkeiten und Schlüsselkompetenzen wie z.B. fächerübergreifendes Denken, Problemlösefähigkeit oder wirtschaftliche Kenntnisse erlernt und erweitert.
Diese Anforderungen an Teams kennen wir in der BMW Group nur zu gut. Daher freuen wir uns, wenn sich qualifizierte Teilnehmer aus dem In- und Ausland bei uns für Praxiseinsätze oder auf offene Stellen bewerben. Verschiedene Bereiche wie z. B. Die Forschung und Entwicklung suchen begeisterte Nachwuchsingenieure, die genauso wie unsere Mitarbeiter Spaß daran haben, auf höchstem Niveau an innovativen Themen mitzuwirken.

Bosch Engineering

BOSCH
Invented for life

Bernhard Bihr
President, Bosch Engineering GmbH

Bosch Engineering GmbH is an innovative partner for development tasks for vehicle and engine manufacturers worldwide. We develop individual and sustainable solutions for electronic systems which make mobility safe, clean and economical. Our portfolio ranges from automotive, industrial and marine applications, railway and commercial vehicles, construction and agricultural machinery to powersports and general aviation. This wide range of applications shows us how important young talent with fresh ideas and extraordinary engagement are.

Formula Student gives students the chance to prove their abilities in different categories and to cope with interdisciplinary challenges in a team. For these reasons we support the Formula Student and promote these young engineers. Furthermore the Formula Student is a great opportunity to get in contact with highly motivated and well educated students.

We are looking forward to an exciting competition and wish all teams good luck!

Die Bosch Engineering GmbH ist ein innovativer Partner für Entwicklungsaufgaben für Fahrzeug- und Motorenhersteller. Wir entwickeln individuelle und nachhaltige Lösungen für Elektroniksysteme, mit denen wir Mobilität sicher, sauber und sparsam machen. Unsere Bandbreite reicht dabei von automobilen und industriellen Anwendungen über Landmaschinen, Freizeit-, Schienen- und Nutzfahrzeuge bis zur allgemeinen Luftfahrt. Diese große Anwendungsvielfalt zeigt uns, wie wichtig junge, motivierte Talente mit frischen Ideen und großem Engagement sind.

Die Formula Student bietet Studenten die Chance, ihre Fähigkeiten unter Beweis zu stellen und Herausforderungen im Team zu meistern. Es ist uns ein großes Anliegen, dieses Engagement zu unterstützen und den Ingenieurnachwuchs zu fördern. Für uns ist die Formula Student zudem eine sehr gute Möglichkeit, mit hochmotivierten und qualifizierten Studenten ins Gespräch zu kommen.

Wir freuen uns auf einen spannenden Wettbewerb und wünschen allen Teams viel
Erfolg!

Brunel
access to excellence

Dr. Ralf Napiwotzki
General Manager, Brunel GmbH

Brunel has been sponsoring Formula Student Germany (FSG) since 2006. Again and again, we are thrilled to see the creativity, passion and team spirit demonstrated by the students who take part. Technical skills and strength of will are essential assets without which the challenges posed by this design competition could never be mastered; and the attributes we see in the FSG participants are the ones we also prize in our own people. We are looking for engineers who share our love of a challenge and who can handle technologically demanding projects. Brunel offers qualified engineers and developers an exciting array of assignments, solid prospects for the future and plenty space for personal and career development. That is why it is very important to us to position Brunel as an attractive employer in the context of FSG and to engage in dialog with the individual participants.

Seit 2006 begleitet Brunel die Formula Student Germany als Sponsor. Von der Kreativität, Leidenschaft und dem Teamgeist der teilnehmenden Studenten sind wir immer wieder aufs Neue begeistert. Fachkompetenz und Willensstärke sind die Grundlagen, die gestellten Herausforderungen bei diesem Konstruktionswettbewerb überhaupt zu meistern. Alles Eigenschaften, die wir an unseren eigenen Mitarbeitern und den FSG-Teilnehmern sehr schätzen. Für unsere technologisch anspruchsvollen Projekte suchen wir Ingenieure, die unsere Leidenschaft für Herausforderungen teilen. Brunel bietet qualifizierten Ingenieuren und Entwicklern ein spannendes Aufgabenfeld mit sicheren Perspektiven und breitem Raum für die eigene berufliche und persönliche Entwicklung. Deshalb ist es für uns sehr wichtig, Brunel als attraktiven Arbeitgeber bei der FSG vorzustellen und mit den einzelnen Teilnehmern ins Gespräch zu kommen.

Continental

Sehnaz Özden
Global Head of Corporate Employer Branding & Recruiting, Continental AG

The past year was the most successful one in the 140 years` history of the Continental AG. To cope excellent with future challenges we need employees who convince us with their engagement, enthusiasm for technology and innovative ability and who want to work in collaboration with us on the individual mobility of the future.
Formula Student is the perfect platform to get in touch with such students. Therefore we have been supporting teams on all five continents with components and know-how from the whole corporate group of Continental for several years. Even teams from the Formula Student Electric can count on our support.
Both competitions unify one thing: Students have the opportunity to proof their interdisciplinary abilities. Furthermore, such a large international project also shapes the factors of social competence challenging all our newcomers.

We are looking forward to further cooperation with the future-elite of engineers.

Good luck in Hockenheim!

Das vergangene Jahr war das erfolgreichste in der 140-jährigen Geschichte der Continental AG. Um auch die zukünftigen Herausforderungen exzellent zu meistern, benötigen wir MitarbeiterInnen, die durch Einsatzbereitschaft, Technikbegeisterung und Innovationsfähigkeit überzeugen und gemeinsam mit uns an der individuellen Mobilität der Zukunft arbeiten wollen.
Die Formula Student ist die ideale Plattform, um mit solchen Studierenden in Kontakt zu kommen. Daher unterstützen wir bereits seit einigen Jahren auf fünf Kontinenten Teams mit Komponenten und Know-how aus dem gesamten Continental-Konzern. Auch Teams der Formula Student Electric können auf unsere Hilfe bauen.
Was beide Wettbewerbe eint: Studierende haben die Möglichkeit, ihre interdisziplinären Fähigkeiten unter Beweis zu stellen. Zudem schärft ein derartiges internationales Großprojekt die Sozialkompetenzfaktoren, die wir bei allen unseren Einsteigern suchen.

Wir freuen uns auf die weitere Zusammenarbeit mit der Ingenieurelite von Morgen.

Viel Glück für Hockenheim!

DAIMLER

Peter Berg
Head of Global Talent Acquisition & Development, Daimler AG

Enthusiasm and passion for innovation and technology are the driving force of the Automotive Industry.

This eagerness is felt among all participants that show enormous engagement and endurance when working on their racing cars. Excellent knowledge of their field of activity, the comprehension of complex dependences and team work are decisive qualities shown in this competition and this exactly matches our requirements of gaining qualified junior staff.

With our engagement we wish to make a contribution to bring forward the innovation force and enhance sustainably the passion of young talents for the Automotive Industry. We are looking forward to interesting discussions with the participants in order to show them the possibilities of starting their career with Daimler.

We wish all participants a huge amount of energy and a successful event!

Begeisterung und Leidenschaft für Innovationen und Technik sind der Motor der Automobilindustrie.

Diesen Enthusiasmus spüren wir bei den Teilnehmern, die mit viel Engagement und Ausdauer an ihren Rennwagen arbeiten. Exzellentes Fachwissen, das Erfassen komplexer Zusammenhänge und Teamwork sind entscheidende Qualitäten, die bei diesem Wettbewerb unter Beweis gestellt werden. Diese entsprechen genau unseren Anforderungen bei der Gewinnung qualifizierter Nachwuchskräfte.

Wir möchten mit unserem Engagement einen Beitrag dazu leisten, die Innovationskraft der jungen Talente und ihre Begeisterung für die Automobilindustrie zu fördern. Bei dem Formula Student Event freuen wir uns auf interessante Gespräche mit den Teilnehmern, um ihnen Möglichkeiten zum beruflichen Einstieg bei Daimler aufzuzeigen.

Wir wünschen den Teilnehmern eine ganze Ladung Energie und eine erfolgreiche Veranstaltung!

DEKRA
On the safe side.

Clemens Klinke
Chairman of the board of managing directors, DEKRA Automobil GmbH
Member of the board, DEKRA SE

DEKRA supports Formula Student Combustion and Formula Student Electric from the outset as technical partner. Our engineers have well grounded know how and expertise in professional motor racing, for example as technical supervisors in the German Touring Car Masters (DTM) championship. In 2011 again the structure of all vehicles has been proven at the DEKRA Technology Centre regarding safety in rollover, side and frontal impacts. Approx. two dozen teams brought the frontal crash attenuators of their bolides for testing directly to the DEKRA Technology Center. This way Formula Student provides the students the opportunity to make their first personal contacts with DEKRA.

As Europe's largest organisation of technical experts, DEKRA is constantly on the lookout for highly motivated employees who have a high level of knowledge, teamwork skills and initiative - and, as we say in Germany, "who have petrol in the veins".

DEKRA unterstützt die Formula Student Combustion und Formula Student Electric seit ihrem Beginn als technischer Partner. Unsere Ingenieure verfügen über umfangreiches Know-how und Erfahrungen im professionellen Rennsport, unter anderem als Technische Kommissare der Deutschen Tourenwagen Masters (DTM). Das DEKRA Technology Center hat auch im Jahr 2011 alle Fahrzeugstrukturen im Hinblick auf die Sicherheit beim Fahrzeugüberschlag, beim Seitenanprall und beim Frontalanprall überprüft. Rund zwei Dutzend Teams ließen die energieabsorbierenden Frontalaufprallstrukturen ihrer Boliden direkt im DEKRA Technology Center testen. So bietet die Formula Student den Studierenden die Möglichkeit, erste persönliche Kontakte zu DEKRA zu knüpfen.

Als Europas größte Sachverständigen-Organisation ist DEKRA ständig auf der Suche nach motivierten Mitarbeitern mit hohem Wissensstand, Teamfähigkeit und Eigeninitiative, die "Benzin im Blut" haben.

Anne Bentfeld
Central Area Manager Publications and Communication,
HARTING Technology Group

The HARTING Technology Group is a globally operating market-leading company in the field of electrical and electronic connection and network technologies. The Student Formula project enables us to promote talented and motivated young people. They are the next generation of technical experts, which Germany - as an industrial location - needs in order to meet the challenges of the future. Under this project, students show what they are capable of in terms of teamwork while applying their technical expertise and strong commitment. Our dual students are also taking part in the Student Formula project – which naturally makes us very proud.

Die HARTING Technologiegruppe ist ein weltweit marktführendes Unternehmen im Bereich der elektrischen und elektronischen Verbindungs- und Netzwerktechnik. Die Formula Student ermöglicht es uns, talentierte, motivierte, junge Menschen zu fördern. Denn sie sind der technische Nachwuchs, den der Industriestandort Deutschland braucht, um zukunftsfähig zu sein. Die Studenten stellen im Rahmen dieses Projekts unter Beweis, was sie in Teamarbeit und mit Hilfe ihres technischen Fachwissens und ihres großen Engagements leisten können. Auch unsere dualen Studenten sind bei der Formula Student dabei – worauf wir natürlich besonders stolz sind.

Rudolf Neumayer
Manager Technical Customer Service, Henkel AG & Co. KGaA

Heinz Siggemann
Sales Manager Industry, Henkel AG & Co. KGaA

Anyone who can create fascinating solutions from limited resources has the potential to do great things. More than ever before, in all technology-driven industries, we need young, curious engineers – people with a passion to master future challenges innovatively and sustainably. This is precisely why we at Henkel, the world market leader in adhesives and sealants, are committed to fostering young engineers and this competition in particular. Conventional joining techniques, such as screw-fastening, welding and riveting, are being reviewed for fundamental fitness in many industries. Often, adhesive bonding proves to deliver superior results. It can join very dissimilar materials and also offer powerful additional features, thus turning out to be a real innovation driver, especially for engineers. For all of these reasons, we will be glad to advise contestants anywhere in the world.

Wer mit überschaubaren Mitteln in der Lage ist, faszinierende Lösungen zu erarbeiten, der kann Großes schaffen. In allen technologiegetriebenen Branchen brauchen wir heute mehr denn je junge, neugierige Ingenieure mit Leidenschaft, um die Aufgaben der Zukunft innovativ und nachhaltig meisten zu können. Deshalb empfinden wir von Henkel, als Weltmarktführer im Bereich der Kleb- und Dichtstoffe, die Förderung des Nachwuchses und dieses Wettbewerbs geradezu als Verpflichtung. Speziell konventionelle Fügemethoden wie Schrauben, Löten und Schweißen werden in vielen Industriezweigen grundsätzlich überdacht. Oft erweist sich die Klebetechnik dabei als überlegen: Sie verbindet verschiedenartigste Materialien, bietet leistungsstarke Zusatzeigenschaften und entpuppt sich so gerade für Ingenieure als Innovationstreiber. Daher stehen wir allen Teilnehmern weltweit jederzeit gerne beratend zur Seite.

Christian Willenberg
Public Relations, IAV GmbH Ingenieurgesellschaft Auto und Verkehr

With over 4,000 members of staff, IAV is one of the world's leading providers of engineering services to the automotive industry. The company can look back on 25 years of experience in developing innovative concepts and technologies for future vehicle generations. Core competencies include perfected, production-ready solutions in all fields of powertrain, electronics and vehicle development.
IAV supports Formula Student and individual teams to produce interest to take part in the engineering departments of the company. To name one example from the motorsport segment: IAV was involved in developing a 2-liter four-cylinder high-speed engine for mass production. Powered by this engine, the BMW 320si went into mass production as the base vehicle for touring-car racing.

For further information about IAV, go to www.iav.com and our careers portal at www.iav-inside.com.

IAV ist mit über 4.000 Mitarbeitern weltweit einer der führenden Engineering-Partner der Automobilindustrie. Das Unternehmen entwickelt seit über 25 Jahren innovative Konzepte und Technologien für zukünftige Fahrzeuggenerationen. Zu den Kernkompetenzen gehören perfekte, serientaugliche Lösungen in allen Bereichen der Antriebsstrang-, Elektronik-, und Fahrzeugentwicklung.
IAV unterstützt Formula Student Germany und einzelne Teams – auch um das Interessen einer Mitwirkung in den Fachabteilungen zu erwecken. Um ein Beispiel aus dem Bereich Motorsport zu nennen: IAV war bei der Serienentwicklung eines 2-Liter-Vierzylinder-Hochdrehzahlmotors beteiligt. Als Grundlage für den Tourenwagensport ging der BMW 320si mit diesem Motor in Serie.

Weitere Infos zur IAV erhalten Sie über www.iav.com und unser Karriereportal www.iav-inside.com.

Christina Schulte
Head of Management Development and HR Marketing
MAHLE International GmbH

The MAHLE Group is one of the top 30 automotive suppliers and the globally leading manufacturer of components and systems for the internal combustion engine and its peripherals. More than 47,000 employees work at over 100 production plants and eight research and development centers.

MAHLE has enjoyed close ties to motor sport activities since the early days. Thus we know: if you want to do something decisive, you need a vision, topped with courage, perseverance, and drive. When the environment fits and the team is right, ambitious projects and convincing solutions emerge from innovative ideas. As a company with a passion for the automobile, we are proud to be part of the Formula Student Germany. We support formula student teams who are fascinated by the automotive world and who want to bring about change - in the same way we are.

We are happy to support talented and enthusiastic engineers in reaching their ambitious goals and we wish you all an exciting and successful event!

Der MAHLE Konzern zählt zu den 30 größten Automobilzulieferern und ist der weltweit führende Hersteller von Komponenten und Systemen für den Verbrennungsmotor und dessen Peripherie. MAHLE beschäftigt mehr als 47.000 Mitarbeiter an über 100 Produktionsstandorten und in 8 Forschungs- und Entwicklungszentren.

Als ein von Anfang an dem Motorsport verbundenes Unternehmen wissen wir: Wer Entscheidendes bewegen will, braucht eine Vision. Und dazu Mut, Ausdauer und Biss. Wenn dann noch das Umfeld stimmt und das Team das richtige ist, werden aus innovativen Ideen ehrgeizige Projekte und überzeugende Lösungen. Als ein Unternehmen mit einer Leidenschaft für das Automobil, sind wir stolz, ein Teil der Formula Student zu sein. Wir unterstützten dabei Teams, die – genauso wie MAHLE – fasziniert sind von der Automobilindustrie und gemeinsam mehr bewegen wollen.

Wir freuen uns, talentierte und enthusiastische angehende Ingenieure bei der Erreichung ihrer ehrgeizigen Ziele zu unterstützen und wünschen allen Teilnehmern ein erfolgreiches Event!

MAN

Stefan Knecht
Senior Vice President (Engineering Truck and Cabin), MAN Truck & Bus AG

MAN has been committed to racing for many years now and competes with passion even if the way leads over rough tracks. For decades now our vehicles have proved in the Dakar Rally and in truck racing how reliable they are and thrill spectators and customers alike. Our employees put their hearts into developing efficient transport solutions. And we will be among the leaders in future too, because we support creative minds in realising their ideas and promote interdisciplinary cooperation. At the Formula Student young people with inventive minds and ambition come together and develop an overall concept that will bring them across the finishing line first – these are kind of junior staff that we need!

MAN engagiert sich seit Jahren für den Rennsport und ist mit Leidenschaft dabei, auch wenn es über unwegsame Pisten geht. Auf der Rally Dakar und in den Truck Race Rennen beweisen unsere Fahrzeuge seit Jahrzehnten ihre Zuverlässigkeit und begeistern Zuschauer und Kunden. Unsere Mitarbeiter sind mit Herzblut dabei, wenn es darum geht, effiziente Transportlösungen zu entwickeln. Und wir werden auch zukünftig ganz vorne mitfahren, weil wir kreative Köpfe bei der Umsetzung ihrer Ideen unterstützen und interdisziplinäre Zusammenarbeit fördern. So kommen auf der Formulare Student junge Menschen mit Erfindergeist zusammen und entwickeln mit Ehrgeiz ein Gesamtkonzept, dass sie als erster ins Ziel bringen soll – solche Nachwuchskräfte brauchen wir!

SIEMENS

Michael Valentine-Urbschat
CEO, Business Unit Inside Electric Car, Siemens AG

Siemens has been a pioneer in electrical engineering for more than 160 years. Based on this expertise Siemens is re-entering the automotive industry. Therefore, Siemens has founded the new business unit "Inside Electric Car". Our focus is the development and production of components for the electric drivetrain. The portfolio extends from electric motors and power electronics to intelligent onboard charging equipment.

"Inside Electric Car" is a fast growing, dynamic business unit. For this challenge we are looking for pioneers who see this as an opportunity for personal growth. The Formula Student Competition is a great opportunity to get in touch with highly motivated engineers and enables us to support enthusiast talents. We are looking for employees with a clear vision of the future of e-mobility, a sense for technological innovations and the passion to solve future challenges.

Your tomorrow starts today! We are excited to get to know you and wish all teams the best of luck!

Siemens ist seit mehr als 160 Jahren Pionier auf dem Gebiet der Elektrotechnik. In dieser Tradition setzt Siemens auf das Thema Elektromobilität und steigt wieder in den Automobilbereich ein. Zu diesem Zweck hat Siemens das eigenständige Geschäftsgebiet „Inside Electric Car" ins Leben gerufen. Wir fokussieren uns auf die Entwicklung und Produktion von Komponenten für den elektrischen Antriebsstrang. Das Portfolio reicht dabei von Elektromotoren und Leistungselektronik bis zur intelligenten On-Board Ladetechnik.

„Inside Electric Car" ist ein schnell expandierendes, dynamisches Geschäftsgebiet. Dafür brauchen wir Menschen, die ihre berufliche Aufgabe als persönliche Wachstumschance begreifen. Die Formula Student ermöglicht es uns, mit hochmotivierten Ingenieuren ins Gespräch zu kommen und begeisterte Talente mit Pioniergeist zu fördern. Wir suchen Mitarbeiter mit dem visionären Blick für die zukünftige Entwicklung der Elektromobilität, dem richtigen Riecher für technologische Trends und dem Gespür für die Machbarkeit von Innovationen.

Wir freuen uns, Sie kennenzulernen und wünschen allen Teams viel Erfolg!

Klaus Hofmann
responsible for Formula Student at SKF

It's the first time that SKF is one of the main partners of Formula Student Germany. As a leading global automotive supplier SKF also offers solutions for future-oriented driving technologies, e.g. electric mobility. In this field we provided technical support already in advance to several participating teams. Formula Student allows us to get in contact with innovative, dedicated young engineers. SKF as an employer offers attractive opportunities in an international company – such as practical training and programmes for trainees and beginners; promotion and continuous further trainings go without saying.

Erstmals in diesem Jahr ist SKF GmbH Deutschland Partner der Formula Student Germany. Als ein weltweit führender Automobilzulieferer bietet SKF auch Konzepte zukunftsweisender Antriebstechnologien wie z.B. Elektromobilität. Hierfür haben wir bereits im Vorfeld mehrere teilnehmende Teams technisch unterstützt. Formula Student ermöglicht uns, innovative, engagierte Ingenieure der Zukunft kennenzulernen. Als Arbeitgeber hält SKF attraktive Chancen in einem internationalen Umfeld bereit – Praktika, Traineeprogramme bis zum Berufseinstieg; Förderung und ständige Weiterbildung sind selbstverständlich.

Regine Siemann
Head of Global Employer Branding, Tognum AG

2.000 participants, 78 teams, 20 nationalities from Finland to South Africa: The sheer numbers alone promise that this year's FSG will once again be marked by team spirit, multicultural exchange, and a connective passion for technology and the "art of engineering".
As a sponsor Tognum facilitates the annual FSG event for the fourth time in a row. Still, each time we arrive at Hockenheim we cannot help but feel overwhelmed by the indescribable atmosphere, the ingenuity displayed by the teams, and the ardour of their participants.
It is this very enthusiasm for driving technology change on which we also rely in our employees. This year's FSG event therefore sees the first edition of the Tognum Award for the most innovative power train. Because in our mind, what makes a good engineer is not just an eye for the commercially feasible, but above all the pure passion for further developing and optimizing established solutions – join in with us as we move the world!

2.000 Teilnehmer, 78 Teams, 20 Nationalitäten von Finnland bis Südafrika: Schon die Zahlen lassen erahnen, dass die diesjährige FSG wieder von Teamgeist, multikulturellem Austausch und alles verbindender Leidenschaft für Technologie geprägt sein wird.
Als Sponsor ermöglicht Tognum bereits zum vierten Mal die Ausrichtung des Events. Und doch sind wir immer wieder überwältigt von der Atmosphäre vor Ort, dem Ideenreichtum der Teams und der Begeisterung, mit der hier Ingenieurkunst betrieben und Technik weitergedacht wird.
Auf genau diese Begeisterung zählen wir auch bei unseren Mitarbeitern. Auch aus diesem Grund verleiht Tognum dieses Jahr erstmals den Sonderpreis „Most Innovative Powertrain". Denn was einen guten Ingenieur auszeichnet, ist nicht nur ein sicheres Auge fürs kommerziell Machbare, sondern vor allem die pure Leidenschaft daran, bestehende Lösungen weiter zu verbessern. In diesem Sinne: Bewegen auch Sie gemeinsam mit uns die Welt!

Thomas Lieber
Head of Electrical Traction, Volkswagen AG

Volkswagen delivers automotive excellence on almost every scale. Intelligent, innovative and environmentally friendly technologies are the key factors in our success, which is why we are delighted to encourage and support the committed, creative young talent involved in the Formula Student project.
The Formula Student competition enables students to combine theoretical knowledge with practical experience and to gain key qualifications that are crucial for a successful career in our company.
We look forward to an exciting contest, thrilling racing, and the opportunity to engage in dialogue with highly-motivated and qualified students.

We would like to wish all participants every success!

Volkswagen bietet automobile Spitzenklasse in nahezu jeder Größenordnung. Intelligente, innovative und umweltfreundliche Technologien sind unsere Erfolgsfaktoren. Wir freuen uns daher besonders, engagierte und kreative Talente im Rahmen der Formula Student zu fördern und zu unterstützen.
Durch die Formula Student erlernen die Studentinnen und Studenten, theoretisches Wissen und Praxis zu verbinden und auf diese Weise Schlüsselqualifikationen, die für eine erfolgreiche Arbeit und Karriere in unserem Unternehmen wichtig sind.
Wir freuen uns auf einen spannenden Wettbewerb, mitreißende Rennen und darauf, mit hochmotivierten und qualifizierten Studenten in den Dialog zu treten.

Wir wünschen allen Teilnehmern viel Erfolg!

Dr. Michael Ruf
Head of International HR Marketing and Media, ZF Friedrichshafen AG

As a leading worldwide automotive supplier for Driveline and Chassis Technology, ZF is permanently looking for highly qualified, creative and motivated junior staff. Team players with organizational skills as well as well-founded knowledge in project management and cost optimization are just what we need.
As a result of the fact that we find exactly such key qualifications with the Formula students, we have been committed to such undertakings for years. Moreover, we perceive this commitment as an important contribution to raising the education quality as well as practice-orientation at the universities. All in all, it is not part of the ZF corporate culture to constantly ‚just' complain about the lack of qualified engineers and skilled labor. Quite the contrary, we enjoy active participation in the education and training of our future, technical junior staff. The „Formula Student" project makes it possible to link the engineer training and qualification with motorsports - a highly emotional and fascinating topic. I am personally convinced that the entire business site is profiting from such projects, but, primarily us, the ZF Group, as a technology-oriented company.

ZF als ein weltweit führender Automobilzulieferkonzern in der Antriebs- und Fahrwerktechnik ist permanent auf der Suche nach qualifizierten, kreativen und motivierten Nachwuchskräften. Gefragt sind Schlüsselkompetenzen wie Teamfähigkeit, Organisationstalent und solide Kenntnisse in Projektmanagement und Kostenoptimierung.
Da wir genau diese Schlüsselqualifikationen bei den Formula Studenten finden, engagieren wir uns seit vielen Jahren. Wir sehen darin einen wichtigen Beitrag, die Ausbildungsqualität und Praxisnähe an den Hochschulen zu erhöhen. Denn es entspricht nicht der ZF-Unternehmenskultur, über den Ingenieurs- und Fachkräftemangel nur zu reden. Stattdessen beteiligen wir uns lieber aktiv an der Ausbildung des Techniknachwuchses. Das Projekt Formula Student ermöglicht es, die Ingenieursausbildung mit dem Rennsport zu verknüpfen, einem emotional besetzten und faszinierenden Thema. Ich bin davon überzeugt, dass hiervon der ganze Wirtschaftsstandort profitiert, aber natürlich auch wir als Technologiekonzern.

A great friend and fun-loving man with a passion for motorsport

A real petrol head is one way to describe Craig Dawson, a fantastic motorsport engineer.

Craig was born into a world of British motorsport on the 13th March 1981 and grew up to get a name as a driver, a race engineer, a technical leader and a team manager. He travelled the world with different motorsport series from go-karting to Formula 1. And although he was so young, managed to build up a life worth of experiences in the world of motorsport.

Formula Student was his passion in which he engaged himself with during his studies in his team at Oxford Brookes University. This passion exceeded his degree and once he was finished with studying he was not ready to let go and carried on by supervising the Formula Student Team at Oxford Brookes University whilst he was writing his dissertation. After he was done, he continued to support Formula Student with his knowledge and time and became a judge at the FSUK competition in Silverstone, England and at FSG in Hockenheim, Germany.

Craig was a spontaneous and ambitious man with a positive attitude to life. In 2008, next to his duties as a judge, he took over the commentating of the dynamic events at Formula Student Germany. He became "The voice" of Formula Student Germany. Through his deep knowledge as well as amusing and interesting anecdotes about the teams, but also through his easy going attitude he entertained the competitors and visitors during the day and turned the worldwide livestream into a great event.

Unnoticed to everyone was his constant fight against cancer, he fought hard and did not let it get in the way of living. Unfortunately the battle was lost and at the end of 2010 he passed away.

The entire Formula Student community and friends from all over the world will miss him greatly. He will be missed not only by us but also create a gap within the event. Craig had great ideas for this years' event and Formula Student Germany have taken it on to make sure that Craig's Spirit lives on.

Ein toller Freund und lebensfroher Mensch mit einer Leidenschaft für den Motorsport

Wenn Craig Dawson mit wenigen Worten beschrieben werden müsste, dann muss ganz klar gesagt werden, dass er ein fantastischer Motorsportingenieur und ein guter Freund mit einer riesigen Portion Benzin im Blut war.

Am 13. März 1981 in England geboren und unter großem Motorsporteinfluss aufgewachsen, machte er sich in seiner Laufbahn als Fahrer, Renningenieur, technischer Leiter sowie Teammanager einen Namen. Er bewegte sich weltweit in den verschiedensten Motorsportteams vom Kart bis hin zur Formel 1. Auf diese Weise konnte er, obwohl noch immer jung, schon auf eine lange Laufbahn voller Erfahrungen im Motorsport zurückschauen.

In der Formula Student machte er ebenfalls halt und engagierte sich während des Studiums im Team von Oxford Brookes. Nach Beendigung seines Studiums konnte er der Formula Student einfach nicht den Rücken kehren. So fungierte er an der Oxford Brookes Universität weiterhin als Betreuer des Formula Student Teams der Uni, während er seine Dissertation schrieb. Doch hörte sein Engagement hier nicht auf, er wollte den Wettbewerb und die Teams noch besser unterstützen und übernahm Aufgaben als Jurymitglied bei den Wettbewerben in England und Deutschland.

Da Craig ein sehr lebensfroher und spontaner Mensch war, kam es 2008 dazu, dass er neben seiner Aktivität als Jurymitglied bei der Formula Student Germany auch noch die Moderation der dynamischen Events übernahm. „The voice" - die Stimme wurde somit ein fester Bestandteil der Formula Student Germany. Durch sein hervorragendes fachliches Wissen, lustige und interessante Anekdoten über die Teams sowie seine lockeren Sprüche versüßte er den Zuschauern und Teilnehmern den Tag und machte den Livestream auf der ganzen Welt zu einem großen Event.

Was ihm selten anzumerken war, war seine Krebserkrankung. Er hat stets versucht sich nicht unterkriegen zu lassen und dagegen anzukämpfen. Doch leider hat er es nicht geschafft den Kampf gegen den Krebs zu gewinnen. Ende 2010 musste er von uns gehen.

Die gesamte Formula Student Gemeinde und natürlich seine Freunde auf der ganzen Welt vermissen ihn. Er wird nicht nur uns, sondern auch dem Event fehlen. Gemeinsam hatten wir für den Event dieses Jahr große Pläne geschmiedet. Er wird nicht nur in den Herzen der Formula Student Gemeinde, sondern auch beim Event selber ein großes Loch hinterlassen. Doch wir werden versuchen Craigs Spirit weiterleben zu lassen.

Formula Student Germany 2011 wants to tie in with the success of last year's FSG with more than 300 guided visitors, representatives of the press and sponsors. For this purpose in 2011 again three different guided tours will be offered to interested visitors, representatives of the press and sponsors:

Formula Student Basic Tour

The 45 minute Formula Student Basic Tour offers a comprehensive insight into Formula Student Germany with its two vehicle classes, the Formula Student Combustion and the Formula Student Electric. Additional to the explanation of basic idea and competition history the interested visitor gets an overview of the different static and dynamic competitions. While visiting the scrutineering and touring the pit lane, the participants get the chance to soak up the unique atmosphere of the competition and to discuss the characteristics of the different racecars. The focus towards electro or combustion racecars will be adjusted individually as requested by the tour group.

The Formula Student Basic Tour addresses all interested visitors who wish to gain a basic but still comprehensive insight into the Formula Student Germany competition.

Technical Deep Dive - Combustion or Electric

A separate technical deep dive for racecars of the Formula Student Combustion as well as one for vehicles of the Formula Student Electric is offered several times a day. The goal of the technical deep dive is to provide a profound insight into the unique characteristics of each vehicle class and to give an in depth understanding to especially technically interested visitors.

In the context of the Formula Student Electric a specialist and team alumni will focus on the challenges and specialties of electric propulsion.

The deep dive for racecars of the Formula Student Combustion will especially focus on last years' developments as well as dive into this year's special features.

The technical deep dive especially addresses interested visitors who want to get a technically profound and channeled insight into the area of electro or combustion powered racecars. The topic of each deep dive can be set individually by each visitor group.

Bei der Formula Student Germany 2011 soll an den Erfolg vom letzten Jahr mit mehr als 300 geführten Besuchern, Pressevertretern und Sponsoren angeknüpft werden. Hierfür stehen dem interessierten Besucher, unseren Sponsoren und den Pressevertretern auch dieses Jahr drei verschiedene Führungsangebote zur Auswahl.

Formula Student Basic Tour

Während der 45 minütigen Formula Student Basic Tour erhalten die Führungsteilnehmer einen umfassenden Einblick in die Formula Student Germany mit ihren zwei Fahrzeugklassen, der Formula Student Combustion und der Formula Student Electric. Neben der Darstellung von Grundidee und Historie des Events werden dem interessierten Besucher auch die verschiedenen dynamischen und statischen Disziplinen des Wettbewerbs erläutert. Beim Besuch der technischen Abnahme und dem Gang durch die Boxengasse bekommen die Teilnehmer ferner die Möglichkeit die besondere Atmosphäre der Veranstaltung aufzusaugen und sich die Besonderheiten der einzelnen Boliden hautnah erläutern zu lassen. Ob der Fokus einer jeden Führung eher auf Verbrennungs- oder Elektrofahrzeugen gelegt werden soll, kann von der Besuchergruppe individuell entschieden werden.

Die Formula Student Basic Tour richtet sich an alle interessierten Besucher die einen grundlegenden und umfassenden Einblick in die Welt der Formula Student Germany wünschen.

Technical Deep Dive - Combustion oder Electric

Sowohl für die Fahrzeuge der Formula Student Combustion als auch für die Boliden der Formula Student Electric, wird bei der Formula Student Germany 2011 mehrmals täglich ein gesonderter Technical Deep Dive angeboten. Das Ziel des Technical Deep Dives ist es spezifische technische Alleinstellungsmerkmale der jeweiligen Fahrzeugklasse zu vertiefen und diese besonders technisch interessierten Besuchern näherzubringen.

Im Rahmen der Formula Student Electric Deep Dives wird ein Spezialist und ehemaliges Teammitglied den Fokus auf die besonderen Herausforderungen und Besonderheiten des elektrischen Antriebes legen.

Der Deep Dive für die Fahrzeugklasse der Verbrennungsmotoren, der Formula Student Combustion, wird insbesondere auf die Entwicklungen der letzten Jahre eingehen sowie die diesjährigen Besonderheiten diskutieren.

Der Technical Deep Dive richtet sich an besonders interessierte Besucher die einen vertiefenden Einblick in den Bereich der Elektro- oder Verbrennungsmotorenfahrzeuge erhalten wollen. Der genaue Themenfokus kann auch hier individuell während der Führung durch die Besuchergruppe festgelegt werden.

The starting point for each guided tour is the info counter inside the FSG Forum. There you will also find schedules with all times and dates for guided tours.

Der Startpunkt für die Führungen befindet sich am Infocounter im FSG Forum. Hier können auch die Startzeiten einer jeden Führung eingesehen werden.


Continental

HENKEL - COMPACT SEMINAR ON BONDING

HENKEL - KOMPAKTSEMINAR KLEBEN

Which adhesive technology is best for which application? When has a bond been designed properly, and which test methods can be used to demonstrate its fitness for use in practice? For the first time, adhesives producer Henkel staged two-day workshops for 40 engineering students on the fundamentals of adhesive technologies and how to apply them.

Applications in drive technology (combustion engines and electric drives) dominated the first day. The main topics were thread locking, gasketing and shaft-hub retaining - both metal-to-metal and metal-to-CRP combinations. Structural bonding of chassis parts using epoxy resins and acrylates were the focus of the second day. Additional insights were offered on the range of applications for release agents, as well as on emergency repairs.

The seminar was received with great enthusiasm - and not just by the students. Dr. Ludwig Vollrath (VDI), comments the importance and success of the workshop: „The knowledge gained here opens up completely new approaches for using adhesive technologies as a design element.“ For Henkel, the adhesive workshops are a logical continuation of its chosen path to promote young engineers.

Workshop in the Henkel Technology and Training Center in Garching

Workshop im Henkel Technologie- und Schulungszentrum am Standort Garching

Bonding - a high-performing alternative

„Although adhesive bonding is gaining ground as a high-performing alternative to conventional joining techniques such as welding, bolting and riveting, the curricula of the universities hardly include any courses at all on this subject,“ says Rudolf Neumayer, head of Application Technology, Industrial Adhesives Europe. „So we decided to take the initiative here.“

Henkel has already been demonstrating its engagement in this direction for years, for example in the Formula Student Design Contest, by providing materials for the participating universities and advising the students on adhesives and bonding matters. Henkel's adhesives experts are now a familiar presence on the Hockenheimring track. This is precisely where the students' need for information became apparent, especially regarding the practical benefits of fast-curing adhesives for emergency repairs.

Two years ago, Henkel instituted its own award for the best use of an adhesive in the overall contest. This too shows the high significance that this future technology has already gained in the minds of these young engineers.
Henkel will again be at the Hockenheimring - and will be concentrating more than ever on providing practical help on site. Plans are already being made to hold follow-up seminars next year.

Welche Klebstofftechnologie eignet sich für welche Anwendung? Wann ist eine Klebeverbindung konstruktiv richtig ausgelegt und mittels welcher Prüfmethoden lässt sich ihre Praxistauglichkeit nachweisen? Erstmals unterwies der Klebstoffhersteller Henkel insgesamt 40 Studenten der Ingenieurswissenschaften in zweitägigen Workshops in Basis- und Detailwissen moderner Klebetechnologien.

Anwendungen in der Antriebstechnik (Verbrennungsmotoren und Elektroantriebe) bestimmten den ersten Tag. Dabei standen die Themen Schraubensichern, Flächendichten und Welle-Nabe-Verbindungen, sowohl Metall/Metall- als auch Metall/CFK-Kombinationen, im Vordergrund. Strukturelles Kleben im Bereich des Chassis mit Epoxidharzen und Acrylaten beschäftigte die Kursteilnehmer am zweiten Tag. Weitere Akzente setzte ein Einblick in die Anwendungsbandbreite von Formtrennmitteln und die Notfallreparatur.

Nicht nur die Studenten quittierten das Seminar begeistert, auch Dr. Ludwig Vollrath (VDI) betonte die Wichtigkeit und den Erfolg des Workshops: „Durch das hier gewonnene Wissen, eröffnen sich für die Studenten ganz neue Ansatzpunkte für den Einsatz von Klebetechnik als Konstruktionselement.“ Für Henkel ist das Angebot der Klebeworkshops die konsequente Fortsetzung der bisher eingeschlagenen Nachwuchsförderung.

Hochleistungsfähige Alternative Kleben

„Obwohl die Klebetechnik als hochleistungsfähige Alternative zu konventionellen Fügemethoden wie Schweißen, Schrauben und Löten zunehmend an Bedeutung gewinnt, sehen die Curricula der Universitäten Seminarangebote in diesem Bereich bislang kaum vor“, erläutert Rudolf Neumayer, Leiter der Anwendungstechnik Industrieklebstoffe Europa. „Deshalb haben wir die Initiative ergriffen.“

Schon seit Jahren engagiert sich Henkel unter anderem im Rahmen des Formula Student Konstruktionswettbewerbs, fördert teilnehmende Universitäten mit Materiallieferungen und unterstützt die Studenten mit klebetechnischer Beratung. Beim Event auf dem Hockenheimring ist Henkel inzwischen traditionell mit eigenen Klebeexperten präsent. Speziell dort offenbarte sich der Informationsbedarf der Studenten in dem praktischen Nutzen, den ihnen beispielsweise die schnellen klebetechnischen Notfallreparaturen boten.

Vor zwei Jahren hatte Henkel erstmals einen eigenen Award für den besten Klebstoff-Einsatz im Rahmen des Gesamtwettbewerbs ausgeschrieben. Bereits hier zeigte das große Interesse der Studenten, welch einen hohen Stellenwert diese Zukunftstechnologie unter den Nachwuchsingenieuren eingenommen hat.
Auch in diesem Jahr wird Henkel wieder auf dem Hockenheimring dabei sein und zwar mit noch größerer Konzentration auf die praktische Hilfe vor Ort. Die Planungen für ein weiteres Folgeseminar im nächsten Jahr sind ebenfalls schon angelaufen.

Formula Student Germany (FSG) has been held since 2006 in Germany. Each year, in August, student teams from all over the world get together at the Hockenheimring to compete against each other with their self designed racing cars in different static as well as dynamic disciplines. The static disciplines such as design, cost planning and business plan, are assessed by a jury of international experts. During the dynamic disciplines, acceleration, skid-pad, autocross and endurance, the highlight of the competition and dynamic performances of the cars are measured.

The organisers aim to challenge and advance the prospective engineers to prepare them for their professional career. To find out if the organisers of the competition live up to this standard, we interviewed four former FSG participants to ask them about their experiences during the Formula Student and their current professional life. Participants of the interview are Benedikt Fries (Audi Sport), Paul Hurmer (Porsche AG), Michael Kissling (KONTEC GmbH) and Jeroen Klein Geltink (Lotus Renault GP).

How did you get to join a Formula Student Team?

KLEIN GELTINK: I have always been intrigued by cars and especially motorsport. Also the idea of finally being able to put the theory from the classroom into practice and designing, building, and testing a racing car together with a team of highly motivated students inspired me.

HURMER: It was similar for me. I liked the idea and the objective to develop my own racing car. I found out about the Formula Student project at the TU Munich from a fellow student at the end of 2004 and I applied right after.

FRIES: I got in contact with the team through a friend and fellow student who was already involved with TUfast. They convinced me with their concept and made me want to join the team.

KISSLING: In Stuttgart, there was unfortunately no Formula Student team yet. After Sebastian Seewaldt, Konrad Paule and I got wind of the topic Formula Student Germany, we took matters into our own hands and founded the Rennteam Uni Stuttgart in 2005.

How much time and effort did you put into the project?

ALL: A lot!!!

HURMER: The three years I spent in the team were very work intensive. If it was necessary, I worked on the project 7 days a week and almost around-the-clock.

KISSLING: It was similar for me. I spent almost every free minute on the project. Formula Student and motorsport are my passion and I enjoyed being so absorbed by it.

FRIES: It is especially time consuming right before the competition. We worked in the shop to get the car ready for days and nights on end.

KLEIN GELTINK: I spent an unbelievable amount of time and effort for the little racing cars. Only during my second year with the team I had to pause for 6 month due to my internship with Ferrari S.p,A. in Italy.

In Deutschland wird die Formula Student Germany (FSG) seit dem Jahr 2006 veranstaltet. Jedes Jahr im August treffen sich die studentischen Teams aus aller Welt am Hockenheimring, um sich und ihre selbst gebauten Formel Rennwagen in den verschiedenen statischen und dynamischen Wettbewerben miteinander zu messen. Die statischen Wettbewerbe wie Design, Kostenplanung und Businessplan werden von einer internationalen Fachjury bewertet. In den dynamischen Disziplinen, wie Acceleration (Beschleunigung), Skid Pad (8-fahren), Autocross und schließlich dem Höhepunkt der Veranstaltung dem Langstreckenrennen, werden die dynamischen Leistungen des Bolidens gemessen.

Ziel der Organisatoren der Formula Student Germany ist es die angehenden Ingenieure zu fordern und fördern und sie auf diese Weise allumfassend auf ihre berufliche Zukunft vorzubereiten. Um heraus zu finden, ob die ehrenamtlichen Organisatoren des Wettbewerbs diesem Anspruch auch gerecht werden, haben wir vier ehemalige FSG-Teilnehmer interviewt und sie nach ihren Erfahrungen aus ihrer aktiven Formula Student Zeit und ihrem aktuellen Berufsleben befragt. Teilnehmer des Interviews sind Benedikt Fries (Audi Sport), Paul Hurmer (Porsche AG), Michael Kissling (KONTEC GmbH) und Jeroen Klein Geltink (Lotus Renault GP).

Wie seid ihr damals dazu gekommen, in einem Formula Student Team mitzumachen?

KLEIN GELTINK: Autos haben mich schon immer fasziniert und vor allem der Motorsport hat mich gefesselt. Auch die Idee endlich einmal die Theorie des Hörsaals in die Praxis umsetzen zu können und einen Rennwagen mit einem Team von hoch motivierten Studenten zu entwerfen, zu bauen und testen zu können, hat mich begeistert.

HURMER: Mir ging es ähnlich. Die Idee und das Ziel einen eigenen Rennwagen zu entwickeln, fand ich super. Über einen Kommilitonen hatte ich Ende 2004 vom Formula Student–Projekt an der TU München erfahren und habe mich sofort beteiligt.

FRIES: Ich habe über einen Freund und Studienkollegen, der sich bereits bei TUfast engagierte, erste Kontakte zum Team geknüpft. Weil mich das Konzept überzeugt hatte, wollte ich auch mitmachen.

KISSLING: In Stuttgart gab es leider noch kein Formula Student Team. Nachdem Sebastian Seewaldt, Konrad Paule und ich vom Thema Formula Student Germany Wind bekommen hatten, nahmen wir die Sache selbst in die Hand und gründeten 2005 gemeinsam das Rennteam Uni Stuttgart.

Wie viel Zeit und Herzblut habt ihr in das Projekt investiert?

ALLE: Viel!!!

HURMER: Die drei Jahre, die ich im Team mitgemacht habe, waren schon sehr arbeitsintensiv. Wenn es nötig war habe ich 7 Tage die Woche fast rund um die Uhr für das Projekt gearbeitet.

How could you combine your engagement with your studies?
KISSLING: The studies took place alongside.
HURMER: It was an important piece of work to not lose sight of your friends in addition to Formula Student and school.
KISSLING: Exam periods were especially tricky since the work in the team didn't reduce to compensate for some "tests", the competition was constantly moving closer and closer. But I could cope with everything and applied good time management.
FRIES: I could have finished my studies two semesters faster if I hadn't joined TUfast, but I would not have gained that amount of practical experience which helps me today.
KISSLING: I was always looking forward to finishing my studies and to be able to dedicate myself to the racing team.

What was the most fun during the participation in the FS team?
HURMER: Applying the own creative ideas into practice as well as achieving ambitious objectives with the team
FRIES: It was of course exciting to go along with the development of a car from the beginning. Especially the work within the team and the various barbeques will be remembered strongly.
KLEIN GELTINK: I liked that what was designed within the team was actually built. It was so much fun to actually see our design drive and not just as a pretty picture constructed by a computer program.
KISSLING: There are so many things I liked, otherwise I wouldn't have stuck to it for so long…the teamwork for example, or designing a complete racing car from scratch and then being able to tune and drive it. It is the variety of tasks to be accomplished which make the project so fascinating.

Michael Kissling on the track
Michael Kissling auf der Strecke

As I was one of the founders of our team, we were able to create something completely new and form it according to our ideas. It was a huge challenge and a lot of fun to build the entire team structure, but it has given me some grey hair as well.

Do you think that your intense work to prepare for the competitions, such as the Formula Student Germany, prepared you for your jobs as well? Was your preparation just technical or more comprehensive?
FRIES: The time at TUfast demonstrated a preparation for the professional life for sure. Alongside technical disciplines I learnt to handle stress and pressure.
HURMER: The work within the Formula Student team defi-

KISSLING: Mir ging es ähnlich. Ich habe so gut wie jede freie Minute für das Projekt gegeben – die Formula Student bzw. Motorsport sind meine Leidenschaft und dementsprechend beschäftigte ich mich viel und gerne damit.
FRIES: Vor allem die Endphasen vor dem Wettbewerb waren sehr zeitintensiv. Nächte lang haben wir noch in der Werkstatt gearbeitet, um das Auto entsprechend fertig zu bekommen.
KLEIN GELTINK: Ich habe eine unglaubliche Menge Zeit und Herzblut in die kleinen Rennwagen investiert. Einzig in meinem zweiten Jahr beim Team, habe ich wegen meines Praktikums bei Ferrari S.p.A. in Italien ein halbes Jahr aussetzen müssen.

Wie hat sich der ganze Einsatz denn dann mit eurem Studium kombinieren lassen?
KISSLING: Das Studium lief bei mir eher nebenher.
HURMER: Es war schon eine große Kunst neben der Formula Student die Uni und seine Freunde nicht zu vernachlässigen.
KISSLING: Knifflig waren besonders die Prüfungsphasen, da die Arbeit im Team „nur" wegen der Prüfungen ja nicht weniger wurde und der Wettbewerb immer näher rückte, doch mit geschicktem Zeitmanagement habe ich alles meistern können.
FRIES: Zwar hätte ich mein Studium ohne TUfast etwa zwei Semester früher beenden können, allerdings konnte ich hier viel praktische Erfahrung sammeln, die mich heute weiter bringt.
KISSLING: Ich freute mich immer riesig darauf, mit dem Lernen aufhören und mich wieder dem Rennteam widmen zu können.

Was hat euch an der Mitarbeit in einem FS Team am meisten Spaß gemacht?
HURMER: Sowohl die eigenen kreativen Ideen selbständig umzusetzen, als auch die großen Ziele im Team zu erreichen.
FRIES: Natürlich war es spannend, die Entwicklung eines Autos von Anfang an zu begleiten. Vor allem werden mir die Arbeit im Team und diverse Grill-Sessions sehr positiv und nachhaltig in Erinnerung bleiben.
KLEIN GELTINK: Mir hat am meisten gefallen das das, was man im Team entworfen hat auch wirklich gebaut wurde. Es hat mir so viel Spaß gemacht, unseren Entwurf später tatsächlich fahren zu sehen und nicht nur als ein schönes Bild, das mit Hilfe eines Computerprogramms erstellt worden ist.
KISSLING: Bei mir gibt es so viele Dinge, sonst wäre ich nicht so lange dabei geblieben… die Teamarbeit zum Beispiel oder von einem weißen Blatt Papier an einen kompletten Rennwagen zu erschaffen und diesen dann noch abstimmen und fahren zu können. Es ist die Vielfalt der Aufgaben, die es zu bewältigen gibt, die das Projekt so faszinierend machen. Da ich zur Gründergeneration des Rennteams gehöre, konnte ich zusammen mit dem Team etwas völlig Neues erschaffen und es nach unseren Vorstellungen formen. Die gesamten Teamstrukturen aufzubauen, war eine große Herausforderung und hat viel Spaß gemacht – aber es hat mir sicher auch das ein oder andere graue Haar eingebracht.

Findet ihr, dass euch die viele Arbeit in Vorbereitung auf die Events, wie der Formula Student Germany, auch auf den Job vorbereitet hat? Fand diese Vorbereitung nur in den technischen Disziplinen oder allumfassender statt?
FRIES: Auf jeden Fall stellte die Zeit bei TUfast eine Vorberei-

nitely prepared me for my professional career. Part of this was team work, achieving goals under time pressure, establishing contacts with companies, preparing presentations and being in charge.

KISSLING: In Formula Student, as an engineer you learn about technical areas, but the experiences within the team are far more valuable. I learnt how important good teamwork and communication is. A team that gets along and has fun with what they are doing is the basis for success.

KLEIN GELTINK: Being a member of a Formula Student team definitely helped me to become a better engineer and as Michael said, I particularly learnt to work within a multidisciplinary team. In addition, I learnt how to deal with limitations that come with the work in a racing team. For instance, each team only has a limited amount of time to build a vehicle. I have the same experiences at my job: a Formula 1 racing car is never ready and at each race, we are constantly bringing aerodynamic updates to the track.

At the end of your education you needed to look for a suitable job. How was the application process for you? Could you use your Formula Student contacts or did you get job offers from companies right away without applying? Or did the participation in the FSG not help at all?

KLEIN GELTINK: I wouldn't say that I could use the contacts from my Formula Student time directly, but being able to show the experience you have was a big help during the application process. This way, I was one step ahead of competitors with a comparable degree. I could show that I am motivated and gained some hands-on experience. In addition, it proved my ability to work in a team and to handle time pressure which has a big meaning in racing.

HURMER: The experience helps for sure. In order for the transition from the time as a student to the professional life to be as smooth as possible, I applied for an internship with Porsche Motorsports at the end of my studies. What followed were my thesis and a subsequent employment at the company.

KISSLING: Formula Student can in fact serve as a springboard. Through my contacts from the Formula Student I got the possibility for my Diplom thesis at my present employer KONTEC in 2008. My first service for Audi Sport emerged from my thesis again with the help of contacts I probably wouldn't have had without the Formula Student.

FRIES: That is true. I was recommended by a TUfast sponsor for a thesis at Audi Sport without having applied for it. Subsequently, I got a concrete job offer.

Benedikt Fries shortly before the race
Benedikt Fries kurz vor dem Rennen

tung auf meinen Beruf dar. Neben den technischen Disziplinen, lernte ich vor allem mit Stress und Druck umzugehen.

HURMER: Die Arbeit im Formula Student Team hat mich auf jeden Fall auf das Berufsleben vorbereitet. Dazu gehören das Arbeiten im Team, Ziele unter Zeitdruck zu erreichen, Kontakte zu Firmen zu knüpfen, Präsentationen vorzubereiten und Verantwortung zu tragen.

KISSLING: Als Ingenieur lernt man bei der Formula Student natürlich viel auf technischem Gebiet, aber noch wertvoller sind die Erfahrungen im Team. Ich habe gelernt wie wichtig gemeinsame Zusammenarbeit und Kommunikation sind. Ein Team, das sich gut versteht und Spaß bei der Arbeit hat, ist der Grundstein des Erfolges!

KLEIN GELTINK: Ein Mitglied in einem Formula Student Team zu sein, hat mir auf jeden Fall geholfen ein besserer Ingenieur zu werden, und wie Michael schon gesagt hat, habe ich vor allem gelernt in einem multi-disziplinären Team zu arbeiten. Zusätzlich habe ich gelernt, wie man mit Einschränkungen umgeht, die die Arbeit in einem Rennteam so mit sich mitbringt. Zum Beispiel hat jedes Team nur eine begrenzte Zeit für den Bau eines Fahrzeugs. Diese Erfahrungen mache ich nun auch in meinem jetzigen Job: ein Formel 1 Rennwagen ist niemals fertig und bei jedem Rennen bringen wir neue aerodynamischen Updates mit zur die Rennstrecke.

Kurz vor dem oder am Ende des Studiums musstet ihr euch nach einem passenden Job umsehen. Wie hat sich die Bewerbungsphase für euch gestaltet? Konntet ihr Kontakte von der FSG nutzen oder habt ihr direkt von Firmen einen Job angeboten bekommen ohne euch zu bewerben? Oder hat euch die Teilnahme an der FSG gar nicht geholfen?

KLEIN GELTINK: Ich würde nicht sagen, dass ich direkt aus meiner Formula Student Zeit Kontakte mitnehmen konnte, aber schon allein diese Erfahrung vorweisen zu können, hat mir während des Bewerbungsprozesses eine Menge geholfen. Auf diese Weise war ich Konkurrenten mit vergleichbarem Diplom einen Schritt voraus. So konnte ich zeigen, dass ich motiviert bin und bereits „hands on" Erfahrungen gesammelt habe. Zusätzlich konnte ich zeigen, dass ich Teamfähig bin und mit Zeitdruck umgehen kann, der im Rennsport eine große Bedeutung hat.

HURMER: Die Erfahrung hilft bestimmt. Damit der Sprung von der Zeit als Student in das spätere Berufsleben möglichst reibungslos funktioniert, hatte ich mich zum Ende meines Studiums für ein Praktikum bei Porsche Motorsport beworben. Es folgten eine Diplomarbeit und die anschließende Anstellung im Unternehmen.

KISSLING: Die Formula Student kann hier tatsächlich als Sprungbrett funktionieren. Durch Kontakte aus meiner Formula Student Zeit kam ich Ende 2008 zu meiner Diplomarbeit bei meinem jetzigen Arbeitgeber KONTEC. Aus der Diplomarbeit heraus ergab sich dann mein Einsatz bei Audi Sport, auch hier wieder durch Kontakte, die ich ohne die Formula Student vermutlich nicht gehabt hätte.

FRIES: Stimmt. Ich wurde von einem TUfast-Sponsor für eine Diplomarbeit bei Audi Sport empfohlen ohne mich vorher dafür beworben zu haben. Dort wurde mir auch im Anschluss daran ein konkretes Jobangebot gemacht.

Wie haben die Firmen darauf reagiert als ihr von eurem Engagement in einem FSG Team erzählt habt? Kannten denn schon alle die Formula Student oder musstet ihr manchen sogar noch erklären was das ist?

How did the companies react when you told them about your activities in a FSG team? Did everybody know Formula Student or did you have to explain what it is to some of them?

FRIES: Most companies didn't know about Formula Student, but they were quickly convinced by the concept due to the many positive experiences.

HURMER: I experienced it differently. All companies knew about Formula Student. Their reaction was positive throughout.

KISSLING: Formula Student is getting more and more known in Germany, especially due to the targeted work of Formula Student Germany and the VDI. Most companies I deal with have heard of it at least. Especially if applying in motorsports as an intern, for a thesis, or as a young professional, you sometimes have to justify if you can't show any Formula Student experience.

KLEIN GELTINK: And not just in Germany. Also Lotus Renault GP had heard about Formula Student. Many of my colleagues were member of a Formula Student team during their studies. Some of them are judges at the Formula Student competition in Great Britain. The reaction in our company to the Formula Student is positive without exception.

Did you get your dream job with the help of the FS or is it only the first step on the job ladder?

FRIES: Of course it is an absolute dream for an engineer to work in motorsports. But especially in this sector, it is important to focus on your personal development to not stand still.

HURMER: I can definitely say that my current job is my dream job.

KLEIN GELTINK: It is the same for me. To work as a development engineer in aerodynamics for a Formula 1 team is a dream that came true. It is even better than I expected. The work in a Formula 1 team is very stressful but a lot of fun as well to work with highly motivated, young colleagues in a very ambitious industry. It is even more unbelievable to see your own work on TV.

KISSLING: I reached my first goal for sure: I work in motorsport. My career entry in aerodynamics is a field with which I haven't had much experience before. This is the first step of my career to broaden my horizons. In the future, I would like to engage in the areas of road testing, testing or racing participation where I could better apply my strengths.

Do you think you would have obtained your job without the participation in the FSG and that you could accomplish it with the same know-how? What do you see as the value added to the education of an engineer and the engineering degree through the work in a Formula Student team?

KLEIN GELTINK: Without Formula Student, my know-how would definitely not be the same as it is now. It would be constrained to aerospace aerodynamics. Only the participation in Formula Student offered me the possibility to learn how many areas are included during the development of a racing car.

KISSLING: If I had not participated in Formula Student, I would most likely not be at the point I am right now and some know-how would be missing for sure. Formula Student supplements the engineering education by allowing for a very high practical side.

HURMER: I wouldn't have got my current job as a first job without Formula Student. However, the experience with Formula Student made the job entry unproblematic.

FRIES: Die meisten Firmen kannten die Formula Student nicht, sie ließen sich jedoch sehr schnell auf Grund vieler positiver Erfahrungen von dem Konzept überzeugen.

HURMER: Ich habe hier gegenteilige Erfahrungen gemacht. Bei mir war allen Firmen die Formula Student ein Begriff. Sie haben durchweg positiv reagiert.

KISSLING: Die Formula Student wird in Deutschland immer bekannter, insbesondere durch die gezielte Arbeit der Formula Student Germany und des VDI. Die meisten Firmen mit denen ich in Kontakt komme, haben zumindest schon einmal davon gehört. Insbesondere bei Bewerbungen in der Motorsportwelt muss man sich als Praktikant / Diplomand / Berufseinsteiger inzwischen oftmals rechtfertigen, falls man keine Formula Student Erfahrung vorweisen kann.

KLEIN GELTINK: Und nicht nur in Deutschland. Bei Lotus Renault GP hatten sie auch schon von der Formula Student gehört. Viele meiner Kollegen waren während des Studiums bei einem Formula Student Team aktiv. Manche sind sogar Juroren beim Formula Student Wettbewerb in England. Die Resonanz auf die Formula Student in unserem Unternehmen ist ausnahmslos positiv.

Habt ihr damit euren Traumjob ergattert und / oder ist dies nur der erste Schritt auf der Karriereleiter?

FRIES: Natürlich ist es ein absoluter Traum, als Ingenieur im Bereich Motorsport arbeiten zu können. Allerdings ist es gerade in dieser Branche wichtig, sich ständig weiterzuentwickeln und nicht stehen zu bleiben.

HURMER: Von meinem aktuellen Job kann ich auf jeden Fall behaupten, dass es sich hier um meinen Traumjob handelt.

KLEIN GELTINK: Das sehe ich auch so. Als Entwicklungsingenieur Aerodynamik für ein Formel 1 Team zu arbeiten ist ein Traum, der Wahr geworden ist, es ist sogar noch besser als ich erwartet hatte. Die Arbeit in der Formel 1 ist sehr stressig, aber es macht auch sehr viel Spaß mit hoch motivierten jungen Kollegen in einer sehr anspruchsvollen Industrie zu arbeiten. Noch viel unglaublicher ist es jedoch, deine eigene Arbeit im Fernsehen zu sehen.

KISSLING: Ich habe auf jeden Fall mein erstes Ziel erreicht: Ich arbeite im Motorsport. Mit meinem Berufseinstieg im Bereich Aerodynamik bin ich in ein neues Themenfeld gerutscht, in dem ich vorher noch wenig praktische Erfahrungen hatte. Dies sehe ich als ersten Schritt meiner Karriere, um meinen Horizont zu erweitern. Zukünftig möchte ich mich gerne stärker mit den Bereichen Fahrversuch, der Erprobung oder dem Renneinsatz beschäftigen, da ich hier meine Stärken besser einbringen könnte.

Glaubt ihr, dass ihr diesen Job auch ohne die Teilnahme an der FSG bekommen hättet und mit dem gleichen Know-how erfüllen könntet? Was ist aus eurem Blick der Mehrwert der Mitarbeit in einem Formula Student Team für die Ausbildung als Ingenieur und das Ingenieursdiplom?

KLEIN GELTINK: Ohne die Formula Student wäre mein Know-how auf keinen Fall auf dem gleichen Level wie jetzt. Es würde sich nur auf den Bereich Luft- und Raumfahrt Aerodynamik beschränken. Einzig durch die Teilnahme an der Formula Student konnte ich lernen, wie viele Bereiche beim Entwurf und Bau eines Rennwagens einbezogen werden.

KISSLING: Wenn ich nicht an der Formula Student teilgenommen hätte, wäre ich mit großer Wahrscheinlichkeit heute nicht an der Stelle an der ich jetzt stehe und mit Sicherheit würde mir, wie Jeroen sagt, einiges Know-how fehlen. Die Formula Student ergänzt die Ingenieursausbildung um einen sehr hohen Anteil an Praxis.

FRIES: I can only agree. The broad practical knowledge I gained at TUfast facilitated the job entry considerably.

Is the atmosphere at work comparable to that within a Formula Student team or do you sometimes miss the Formula Student atmosphere and would you like to turn the time back to be again able to participate?

HURMER: Technical freedom and short decision making processes as they exist in a Formula Student team aren't possible at every day work. Every now and again I think about how it would be to join a Formula Student project again, but generally speaking I don't want to turn back time. As a design judge, I have the possibility to still be present.

FRIES: Although I can't compare, my job, my degree, the team character, working together on a project and developing a car is still similar. In order to share in the special Formula Student atmosphere, I have been a judge at FSG at the Hockenheimring every year since my active time at TUfast.

KISSLING: I am working with a comparably young team in which I would consider the atmosphere good. However, I experienced the FS atmosphere as unique in particular, the feeling of everybody pulling together to reach a common goal without politics, envy and vanity. If someone makes a mistake (and mistakes happen) it was usually admitted and everybody worked together and tried to straighten it out with great effort. It wasn't about being brilliant as an individual but to reach maximum team performance.

Jeroen Klein Geltink: even delicate work has to be done while building a race-car
Jeroen Klein Geltink: auch filigrane Arbeit ist beim Bau eines Rennwagens gefragt

KLEIN GELTINK: The atmosphere is good in both teams. What I like about the work at Lotus Renault GP is the good organization and the high-quality means that are available. I miss however the unlimited spare rib session with the DUT racing team in particular and the competitions themselves. I was always happy to walk onto the paddock and to ask the other teams about their interesting designs. Although Formula Student is a competition, teams are very open about those things. In Formula 1, it is completely different of course. We try to keep everything a secret.

Would you recommend the participation in a Formula Student team to other students since it is not only fun but also advances you and helps you on your way to a seminal career?

KISSLING: Yes and no. Formula Student is a nice thing – if you like it. Usually, no student receives money for the work they do for their team. That means everybody sacrifices a lot of their free time. This only works if you like the work. Contacts and advanced job chances aren't first priority. If your

HURMER: Meinen aktuellen Job hätte ich als Berufseinsteiger ohne die Formula Student auf keinen Fall bekommnen. Mit meinen Erfahrungen aus der Formula Student war der Berufseinstieg jedoch kein Problem.

FRIES: Da kann ich nur zustimmen. Die umfassenden praktischen Kenntnisse, die ich bei TUfast sammeln konnte, haben mir meinen Berufseinstieg wesentlich erleichtert.

Ist die Stimmung auf der Arbeit vergleichbar mit der in einem Formula Student Team oder vermisst ihr manchmal die Formula Student Atmosphäre und würdet ab und zu gerne die Zeit zurückdrehen, um noch einmal teilnehmen zu können?

HURMER: Die technische Freiheit und die extrem kurzen Entscheidungswege, wie in einem Formula Student Team, gibt es im Berufsalltag natürlich nicht. Ab und zu gehen einem schon Gedanken durch den Kopf, wie es denn wäre noch einmal an einem Formula Student Projekt mitzumachen, aber im Großen und Ganzen möchte ich die Zeit nicht mehr zurück drehen. Als Design Report Judge bekomme ich weiterhin die Möglichkeit bei den Formula Student Wettbewerben dabei zu sein.

FRIES: Zwar kann ich meinen Beruf nicht unbedingt mit der Studienzeit vergleichen, aber ähnlich ist immer noch der Teamgedanke gemeinsam an einem Projekt zu arbeiten und ein Auto zu entwickeln. Um trotzdem noch an der besonderen Atmosphäre der Formula Student teilhaben zu können, bin ich nach meiner aktiven Zeit bei TUfast jedes Jahr als Judge bei der FSG am Hockenheimring tätig.

KISSLING: Ich arbeite in einem relativ jungen Team, in dem ich die Stimmung als gut bezeichnen würde. Dennoch habe ich die Atmosphäre in unserem Formula Student Team als einmalig erlebt. Insbesondere das Gefühl, dass alle an einem Strang ziehen um das gemeinsame Ziel zu erreichen – frei von jeglicher Politik, Neid und persönlicher Eitelkeit. Wenn jemand einen Fehler machte (und Fehler passieren nun einmal immer), wurde dieser im Normalfall offen eingestanden und alle haben gemeinsam versucht ihn mit noch höherem Einsatz auszubügeln. Es ging nicht darum als Individuum zu glänzen, sondern das Maximum im Team zu erreichen.

KLEIN GELTINK: Die Atmosphäre in beiden Teams ist top. Was ich von der Arbeit bei Lotus Renault GP mag, sind die gute Organisation und die hochwertigen Mittel, die einem hier zur Verfügung stehen. Besonders vermisse ich jedoch die unlimitierten Spare Rib Sessions mit dem DUT Racing Team und die Events selbst. Es hat mich jedes Mal gefreut, auf das Paddock laufen zu können und die anderen Teams nach ihren interessanten Entwürfen zu fragen. Obwohl die Formula Student ein Wettbewerb ist, sind die Teams hier in solchen Dingen sehr offen. In der Formel 1 ist das natürlich komplett anders, wir versuchen alles geheim zu halten.

Würdet ihr die Teilnahme in einem Formula Student Team anderen Studenten empfehlen, weil sie nicht nur Spaß macht, sondern einen auch echt weiterbringt und einem den Sprung in den Job und eine zukunftsträchtige Karriere erleichtert?

KISSLING: Ja und nein. Die Formula Student ist eine wunderbare Sache – wenn man Spaß daran hat. Im Normalfall bekommt kein Student Geld für die Mitarbeit in einem Team. Das heißt, alle opfern freiwillig einen Großteil der persönlichen Freizeit. Dies geht nur mit sehr viel Freude an der Tätigkeit. Die Kontakte, die man dabei knüpft und die verbesserten Karrierechancen stehen zunächst im Hintergrund.

primary goal is to brush up your CV it is most likely not going to be a good liaison.

FRIES: The participation is recommendable in any case, but you should know that FSG is not only a springboard for a career but that every FSG team requires committed collaboration of everyone.

HURMER: I recommend the participation to everybody who is prepared to spend their free time for such a project. However, the studies shouldn't be lost track of.

KLEIN GELTINK: The work in a FS team makes everybody a better engineer. This way, participants learn about the engineering world outside of the university. In addition, it is a good way to train your soft skills.

Do you think Formula Student is already well-known enough in the automobile industry or is it necessary to help them along? Which proceedings do you propose?

Paul Hurmer while working on the race-car of his team
Paul Hurmer bei der Arbeit am Rennwagen seines Teams

HURMER: In my opinion, Formula Student is sufficiently known by now. I think there are few companies within the technical automobile sector that haven't received a request from a FS team yet.

FRIES: In fact, many companies from the automobile industry support FS, but the concept and idea of the competition could be further promoted within companies and departments.

KISSLING: Compared to other countries, FSG did a good job in distributing information about the competition. But this is my personal opinion. How many of the relevant companies really know about FSG and what level of familiarity would be desirable, I don't know.

KLEIN GELTINK: I think Formula Student is well-known within the automobile industry. I think it is a very good way to further stay in contact with former team members and let them join the competition as judges. This way, FS remains in their heads and they advertise the project in the companies they work for. As a result, the industry is going to be more involved and engaged in the future.

Do you think that all areas important for the automobile industry are covered through the FS or are there disciplines to be added or others that can be neglected?

KLEIN GELTINK: I don't think anything is missing.

HURMER: I think so too. Everything is covered sufficiently.

KISSLING: Yes. The basic concept is good, which is shown by the high number of participants and the exciting competitions. I can't think of any discipline that is missing or which would be obsolete.

FRIES: I agree as well. In principle, FS is well suited in all areas.

What aspect of FS are you always going to remember?

KISSLING: The experience how much can be achieved with limited means if a group of highly motivated people joins forces for a common goal and if everybody gives 110 percent to reach it.

Wenn jemand primär an eine Mitgliedschaft in einem Formula Student Team denkt, um seinen Lebenslauf aufzupolieren, wird dies höchstwahrscheinlich keine glückliche Liaison.

FRIES: Die Teilnahme ist auf jeden Fall zu empfehlen, allerdings sollte man sich auch im Klaren darüber sein, dass die FSG nicht nur als Sprungbrett für eine Karriere zu sehen ist, sondern, dass das Team der FSG auf die engagierte Mitarbeit von jedem Einzelnen angewiesen ist.

HURMER: Jedem, der bereit ist einen Teil seiner Freizeit in solch ein Projekt zu investieren, kann ich die Teilnahme nur empfehlen. Dennoch sollte das eigentliche Studium nicht aus den Augen verloren werden.

KLEIN GELTINK: Die Mitarbeit in einem FS Team macht einen zu einem besseren Ingenieur. Auf diese Weise lernen die Teilnehmer eher wie es in der Ingenieurswelt außerhalb der Universität zugeht. Zusätzlich es, neben dem technischen Aspekt, ist ein guter Weg seine Soft Skills zu schulen.

Glaubt ihr, dass die Formula Student im Automobilbereich schon bekannt genug ist oder sollte hier ruhig noch ein wenig nachgeholfen werden? Welche Vorgehensweise würdet ihr hier vorschlagen?

HURMER: Aus meiner Sicht ist die Formula Student inzwischen ausreichend bekannt. Ich glaube es gibt kaum eine Firma im technischen Automobilbereich, die noch keine Anfragen von einem Formula Student Team bekommen hat.

FRIES: Zwar unterstützen bereits zahlreiche Firmen aus dem Automobilbereich die Formula Student, teilweise könnten Konzept und Idee des Wettbewerbs innerhalb der Firmen, in den einzelnen Abteilungen, noch etwas bekannter gemacht werden.

KISSLING: Im Vergleich mit anderen Ländern hat die Formula Student Germany in Deutschland bisher gute Arbeit für die Verbreitung des Wettbewerbs geleistet. Das ist jedoch meine subjektive Sichtweide, wie viel Prozent der relevanten Unternehmen die FSG kennen und welcher Bekanntheitsgrad wünschenswert ist kann ich nicht beurteilen.

KLEIN GELTINK: Ich denke, dass die Formula Student innerhalb der Automobilindustrie ziemlich bekannt ist. Ich glaube, ein sehr guter Weg ist weiterhin mit seinen ehemaligen Teamkollegen in Kontakt zu bleiben und diese als Juroren bei den Wettbewerben mitmachen zu lassen. Auf diese Weise bleibt ihnen der Formula Student Gedanke erhalten und sie bewerben das Projekt in den Firmen in denen Sie arbeiten. Auf diese Weise wird die Industrie auch zukünftig involviert und engagiert sein.

Sind eurer Meinung nach alle wichtigen Bereiche, die für die Automobilindustrie relevant sind, durch die Formula Student abgedeckt oder sollten noch weitere / andere Disziplinen hinzu genommen bzw. auf manche verzichtet werden?

KLEIN GELTINK: Ich glaube, dass da nichts fehlt.

HURMER: Das denke ich auch. Meiner Meinung nach sind alle Bereiche / Disziplinen ausreichend abgedeckt.

KISSLING: Ja, aus meiner Sicht ist die Formula Student, wie ich sie erlebt habe, gut. Das Grundkonzept stimmt, was die hohen Teilnehmerzahlen und die spannenden Wettbewerbe zeigen. Aus dem Stehgreif fällt mir keine Disziplin ein, die ich vermisse oder die obsolet wäre.

FRIES: Da stimme ich nur zu. Prinzipiell ist die Formula Student in allen Bereichen gut aufgestellt.

HURMER: The many little victories which encourage you not to abate and to retrieve the best of the vehicle. As a grand finale of my FS time we won the design report at the FSG 2007.
KLEIN GELTINK: I will always remember the front impact test of the impact attenuator of the DUT08 (the 2008 car of the DUT racing team) on my birthday, the early morning exercise of the Delft team during the competition and of course, that we won FSG 2008. For the first time in our team history!
FRIES: Many lasting friendships have emerged from FSG. A highlight was the six weeks our team spent in Australia.

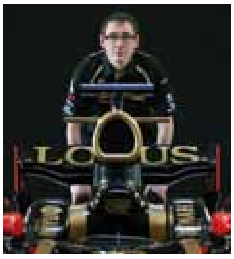
Conclusion of participants and FSG staff:
Participating in Formula Student is worth it in any case. It enriches the practical education, it is very multi-sided, bust mostly: it is a lot of FUN!

An was von der Formula Student werdet ihr euch immer erinnern?
KISSLING: Die Erfahrung, wie viel mit begrenzten Mitteln erreicht werden kann, wenn eine Gruppe von motivierten Leuten sich mit einem gemeinsamen Ziel zusammenschließt und jeder zur Erreichung dieses Ziels 110 Prozent gibt.
HURMER: An die vielen kleinen Erfolgserlebnisse, welche einen bestärkt haben nicht nachzulassen und das Beste aus dem Fahrzeug herauszuholen. Der krönende Abschluss meiner Formula Student Zeit war der Sieg im Design Report bei der Formula Student Germany 2007.
KLEIN GELTINK: Ich werde mich für immer an den „front impact test" den „Impact Attenuator" vom DUT08 (das 2008er Auto vom DUT Racing Team) an meinem Geburtstag erinnern, an den Frühsport des Delfter Teams während der Events und natürlich, dass wir die FSG 2008 gewonnen haben. Zum ersten Mal in unserer Teamgeschichte!
FRIES: Aus der Zeit bei der FSG haben sich viele Freundschaften entwickelt, die immer noch Bestand haben. Ein Höhepunkt war natürlich ein sechswöchiger Aufenthalt unseres Teams in Australien.

Fazit der Teilnehmer und der Redaktion:
An der Formula Student teilzunehmen lohnt sich in jedem Fall. Die Teilnahme bereichert praktisch, ist sehr vielseitig, macht sich ziemlich gut im Lebenslauf und am besten: es macht sehr viel Spaß!

Name	Paul Hurmer	Michael Kissling	Jeroen Klein Geltink	Benedikt Fries
Employer Arbeitgeber	Dr. Ing h.c. F. Porsche AG	KONTEC GmbH employed at Audi Sport eingesetzt bei Audi Sport	Lotus Renault GP	Audi AG – Audi Sport
Position	Development engineer motorsport, chassis Entwicklungsingenieur Motorsport Fahrwerk	Development engineer, aerodynamics Entwicklungsingenieur Aerodynamik	Development engineer, aerodynamics Entwicklungsingenieur Aerodynamik	Thermo management hybrid – motorsport pre-development Thermomanagement Hybrid – Motorsport Vorentwicklung
Former university Ehemalige Universität	TU München, Germany	Universität Stuttgart, Germany	TU Delft, The Netherlands	TU München, Germany
Former FS Team Ehemaliges FS Team	TUfast	Rennteam Uni Stuttgart	DUT Racing Team	TUfast
Member of a FS team from/until Mitarbeit im FS team von/bis	2005 – 2007	2005 – 2009	2007 – 2010	2005 – 2007
Tasks in the FS Team Aufgaben im FS Team	CFK-monocoque, CFK-rims, CFK-drive shaft CFK-Monocoque, CFK-Felgen, CFK-Antriebswelle	Team leader, driver Teamleitung, Fahrer	Impact attenuator, aerodynamic research, side-pods & diffuser Impact Attenuator, Aerodynamische Forschung, Sidepods & Diffuser	Engine team, dry sump Team Motor, Trockensumpf





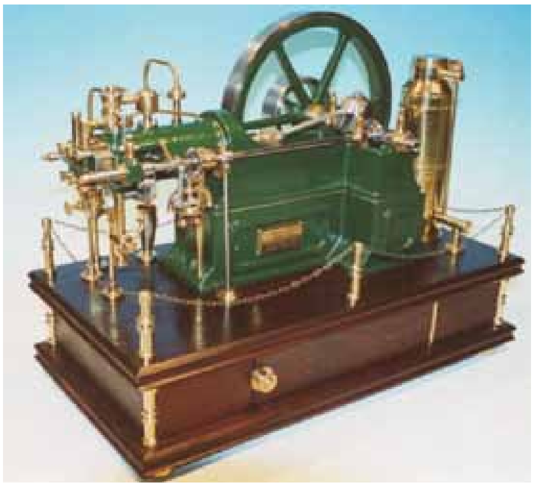

The official hour of birth of the automobile is dated back to the 29th of January 1886, this was the day Carl Benz had his engine-driven three wheeler patented. The patent number 37435 is considered to be the birth certificate of a vehicle that set a milestone in mobility. Getting there was a long and difficult path for many inventors and lateral thinkers.

Source/Quelle: Daimler AG

Carl Benz as a student
Carl Benz als Student

Ideas for an automotive vehicle were already around during the times of Leonardo da Vinci. Drawings from his productive period are included in the Codex Atlanticus, they illustrate a carriage which is moved by mainsprings and could even drive a few meters. The sketches make it evident that lateral thinkers, even at that time, were already thinking about alternative solutions for the "animal drive". The next step on the route to the development of the "car" as it is known today was reached by a French man, Nicolas Cugnot. At the end of the 18th century he introduced his vehicle which was driven by a big steam boiler and is estimated to have been able to drive at about 5km/h. Unfortunately, the presentation of his development failed miserably, as it was not possible to control and was driven into a wall during the demonstration.
Nevertheless, Cugnots idea gave a push in the right direction to further research in this area. Scientists and technology enthusiasts intensely engaged themselves during the following years towards developing steam drives. Francis Moore was one of many who built steam cars from which the so called "steam omnibuses" evolved. They belonged to the first vehicles without draught animals which hit London's roads from as early as 1830. Their successor was the combustion engine driven "Hippomobile" from the French Etienne Lenoir, which he had patented in 1860. This development, as well as later ones, such as a gas driven vehicle by George B. Seldon, did not achieve a breakthrough and were ridiculed by the populace as "monsters".

The essential breakthrough for the drive system wasn't until Nicolaus August Otto produced the "four cycle principle" in 1876. For the first time, his gas engine worked with the compression of the fuel mixture and the combustion at the upper dead centre and thanks to its electric ignition, not just gas but also a better transportable fuel could be burned. Gottlieb Daimler and Wilhelm Maybach further developed the four cycle engine for production with the objective



Source: By courtesy of gaskraftmaschine.de
Quelle: Mit freundlicher Genehmigung von gaskraftmaschine.de

The four cycle engine of Nikolaus Otto
Der Viertaktmotor von Nikolaus Otto

Die offizielle Geburtsstunde des Automobils wird auf den 29. Januar 1886 datiert, denn an diesem Tag lies Carl Benz sein motorgetriebenes Dreirad patentieren. Die Patentnummer 37435 gilt als Geburtsurkunde eines Vehikels, das einen Meilenstein in Sachen Mobilität geliefert hat. Doch um so weit zu kommen, mussten viele Tüftler und Querdenker einen langen und steinigen Weg gehen.

Ideen zu einem Gefährt mit Eigenantrieb konnten schon bei Leonardo da Vinci entdeckt werden. Im Codex Atlanticus existieren Skizzen von ihm aus seiner Schaffenszeit. Diese stellen einen Wagen dar, der durch Triebfedern bewegt wird und auf diese Weise einige Meter weit fahren kann. An den Skizzen ist erkennbar, dass schon zu dieser Zeit Querdenker über Alternativen zum „Antrieb" durch Tierkraft nachdachten. Eine weitere Stufe hin zur Entwicklung des uns heute bekannten Autos, erklomm der Franzose Nicolas Cugnot. Dieser stellte Ende des 18. Jahrhunderts ein Vehikel vor, das mit Hilfe eines großen Dampfkessels angetrieben wurde und ca. 5km/h schnell fahren sollte. Die Präsentation seiner technischen Entwicklung misslang jedoch gewaltig, da sie sich nicht lenken lies und deshalb direkt gegen eine Wand fuhr. Dennoch gab Cugnots Idee weiteren Anstoß auf diesem Gebiet zu forschen. Wissenschaftler und Technikbegeisterte beschäftigten sich im Laufe der kommenden Jahre intensiv mit dem Dampfantrieb. Viele von Ihnen, unter anderem auch Francis Moore, bauten Dampfwagen, aus denen nach und nach die sogenannten Dampfomnibusse entstanden. Sie gehörten zu den ersten Vehikeln ohne Zugtiere, die ab 1830 die Straßen von London unsicher machten. Nachfolger dieser Modelle war das durch einen Verbrennungsantrieb angetriebene Hippomobil des Franzosen Etienne Lenoir, dass dieser sich 1860 patentieren ließ. Wie spätere Entwicklungen zum Beispiel von George B. Seldon, der ein Fahrzeug mit Gasantrieb vorstellte, oder anderer schlauer Köpfe, erzielten diese keinen Durchbruch und wurden von der breiten Masse eher als unnütze Ungetüme verhöhnt.

Erst Nicolaus August Otto gelang der entscheidende Durchbruch beim Antrieb, als er 1876 das Viertakt-Prinzip realisierte. Seine Gasmotoren arbeiteten erstmals mit der Verdichtung des Brennstoffgemisches und der Zündung im oberen Totpunkt und dank seiner elektrischen Zündung konnte ab 1884 nicht nur Gas, sondern auch besser transportierbares Benzin verbrannt werden. Gottlieb Daimler und Wilhelm Maybach entwickelten den Viertaktmotor zur Serienreife weiter mit dem Ziel kleinere und schnelllaufende Motoren für mobile Anwendungen zu entwickeln Darauf aufbauend baute Daimler 1885 seinen ersten Motor-Reitwagen und kann sich damit als Erfinder des ersten vierrädrigen Automobils bezeichnen.

Im Jahr 1886 folgte Carl Benz mit der Patentierung eines moof smaller and faster engines for mobile applications. Based on this, Daimler built his first engine-wagon in 1885 and can therefore be called the inventor of the first four-wheeled automobile.

In 1886, Carl Benz followed with the patent of his engine driven three wheeler reported as the first "vehicle with gas motor engine" in the patent: the Benz Patent Motor Wagon no. 1. The single cylinder had a power of 1ps, an electric ignition, water cooling and a crank shaft. Benz's first ride took place in 1885 to the exclusion of the public in the Mannheimer Fabrikhof for the reason that he wanted to keep his design a secret. At the beginning, it could only run a few 100 meters, this continued to improve bit by bit. After having his three wheeler patented, he demonstrated it to the public several times. He was objected however, more to derision than to broad acceptance. Soon after, the police revoked his permission to drive the motorised three wheeler vehicle. The vehicle was only accepted by the public after Bertha Benz together with her two sons and without the knowledge of her husband, covered the distance of just under 100km from Mannheim to her parents in Pforzheim with the model no. 3. She accomplished it despite the poorly developed road network, the necessity to refill coolant every 20km and the only possibility to buy fuel being from a pharmacy. Her trip on the 5th of August 1888 counts as the first long-distance trip in the history of the automobile. It proved the advantages of her husband's invention and advertised it strongly. This led to the possibility for Benz to sell several patent-engine-wagons and to an increased public interest. Newspapers reported it and first exhibition corporations in Munich and the world exhibitions in Paris 1889 bid on the novel motor carriages to attract technology enthusiasts. This was the beginning of the automobile's commercialisation and led to the modern and mobile society we live in today.

Henry Ford's introduction of the assembly line in 1913 involved the actual triumphal precession of the automobile. It was now possible to manufacture more cars in a shorter time and with less effort which decreased manufacturing costs enormously making the automobile affordable for the population in the US. This was a revolution in automotive engineering. Cars were no longer just luxury goods for the rich. They were also affordable for the middle class, making good money and creating a product for everyday use. As a result, in the 1920s, the automobile become an everyday item in the US, whilst in Germany it was still a symbol for the upper-class lifestyle. It wasn't until the '50s that the automobile became a mass produced product.

During the early stages of the automobile, engineers were still geared to the design of horse-drawn carriages. Driver and passengers sat on a wooden bench in the open without any protection against wind and weather. The vehicle had 3 or 4 carriage wheels and an engine of about 100kg, which operated with 400 rpm. The engines weighing about 300kg, were started with a flywheel, had a one litre engine displace-

torgetriebenen Dreirads, das im Patent als erstes „Fahrzeug mit Gasmotorenbetrieb" ausgewiesen wird: der Benz Patent-Motorwagen Nummer 1. Der Einzylinder hatte etwa 1 PS Leistung, eine elektrische Zündung, Wasserkühlung und Kurbelwelle. Seine ersten Fahrten machte Benz Ende 1885 unter Ausschluss der Öffentlichkeit im Mannheimer Fabrikhof, da er seine Erfindung erst noch geheim halten wollte. Zu Beginn schaffte er nur ein paar 100 Meter, doch nach und nach wurden es mehr. Nach der Patentierung des motorisierten Dreirads führte er es einige Male öffentlich vor. Er erntete jedoch mehr Spott und Hohn als breite Akzeptanz. Bald darauf wurde Benz von der Polizei die Erlaubnis entzogen mit dem motorisierten Dreirad zu fahren. Akzeptanz in der Öffentlichkeit fand das Fahrzeug erst, nachdem Bertha Benz mit ihren beiden Söhnen und ohne das Wissen ihres Mannes den knapp 100km langen Weg von Mannheim zu ihren Eltern nach Pforzheim mit dem Modell Nummer 3 zurücklegte. Trotz des schlecht ausgebauten Straßennetzes, der Notwendigkeit alle 20 Kilometer Kühlwasser nachzufüllen und der Möglichkeit Benzin nur in der Apotheke kaufen zu können, schaffte sie es. Ihre Reise am 5. August 1888 gilt als erste Langstreckenfahrt der Automobilgeschichte. Mit ihr stellte sie die Vorteile der Erfindung ihres Mannes unter Beweis und rührte kräftig die Werbetrommel. Der Werbeeffekt führte dazu, dass Benz danach einige Patent-Motorwagen verkaufen konnte und dass öffentlichen Interesse weiter stieg. Die Zeitungen berichteten darüber und erste Messegesellschaften in München und die Weltausstellung in Paris 1889 setzten auf die neuartigen Motorkutschen als Anziehungskräfte für technikbegeisterte Ausstellungsbesucher. Auf diese Weise begannen die Vermarktung des Automobils und damit der Weg zur modernen und mobilen Gesellschaft von heute.

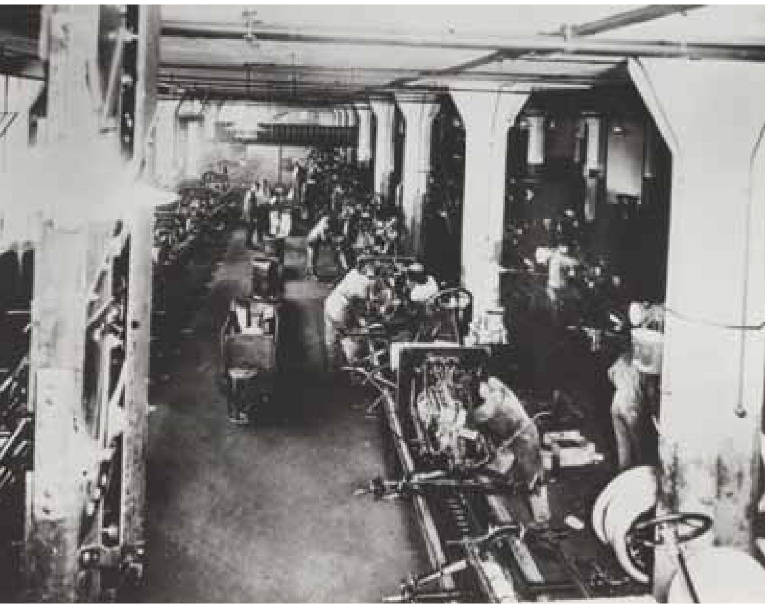
Source / Quelle: Daimler AG

The Benz-Patent-Motor-Vehicle #3
Der Benz-Paten-Motorwagen #3

Source / Quelle: Daimler AG

Bertha Benz and her two sons with the Benz-Patent-Motor-Vehicle #3
Bertha Benz und ihre beiden Söhne auf dem Benz-Patent-Motorwagen #3

Mit Henry Fords Einführung des Fließbandes im Jahr 1913 begann der eigentliche Siegeszug des Automobils. Nun konnten in kürzerer Zeit und mit weniger Aufwand mehr Fahrzeuge hergestellt werden, wodurch die Produktionskosten massiv gesenkt wurden und das Auto in den USA auch für



Source / Quelle : Ford-Werke GmbH

The work on an assembly line of Henry Ford
Die Arbeit an einem Fließband von Henry Ford

ment with only one piston, and were able to drive 16km/h – exciting, considering the circumstances at that time.

After the initially slow development of the automobile, one step quickly followed the other. Already around the turn of the century, the driver sat in a "rolling car", the engine was mostly embedded in the front, both axes were decelerated, and pneumatic tires from Dunlop and later Michelin soon became part of the basic equipment. At the beginning of the 20th century, Robert Bosch produced a high-voltage ignition which forwarded internal combustion engine further. Shortly after, in The Netherlands, Spyker built the first car with an all-wheel drive.

After the initial scepticism had passed, the advantages of the automobile were recognized quickly. Longer distances could be overcome without the need to change horses or to pause for long periods of time to let them rest. The driver was only required to refuel and the drive could continue. Most of all, long distances could not just be covered more easily and comfortably but also faster. The car arranged for an on-going feeling of freedom. Safety deficiencies were a serious issue for a long time. Mainly it was the brakes that were underestimated and often failed. Along with the mass production of cars, the number of accidents also increased. This was mainly due to the fact that the infrastructure was insufficient. Cars, pedestrians, troopers, and carriages at that time had to use the same paths. In addition, there were no priority rights or street signs. Regular severe accidents were often seen at crossing points.

The causes of accidents changed over the years. Due to the improved infrastructure and the introduction of traffic rules, fewer collisions took place. The unsafe equipment of the vehicles, which were becoming faster and faster, as well as the overestimation of the drivers' own capabilities, lead to many fatalities due to excessive speed. The peak of accident statistics was measured in 1970 with 21332 road deaths in Germany. It wasn't until seat belts became mandatory in new cars that the number of accidents decreased drastically.
Many producers ignored the insufficient safety of their products for a long time. Safety awareness just advanced little by little. After the seatbelt requirement, the airbag was introduced in the 80s and ABS and EPS were developed.

die Massen erschwinglich wurde. Dies war eine Revolution im Automobilbau. Autos waren nun nicht mehr länger nur noch Luxusgüter für die Reichen. Sie waren nun für die gut verdienende Mittelschicht bezahlbar und verwandelten sich zu einem alltäglichen Nutzmittel. So wurde das Auto in den USA in den 1920ern zu einem Alltagsgegenstand, während es in Deutschland immer noch als Ausdruck großbürgerlichen Lebensstils galt. Hier dauerte es noch bis in die 50er Jahre hinein, bis das Auto zu einem Massenprodukt wurde.

In den Anfängen des Automobils orientierten sich die Ingenieure noch am Design von Pferdekutschen. Fahrer und Beifahrer saßen auf einer Holzbank im Freien ohne Schutz vor Wind und Wetter, das Fahrzeug hatte 3 oder 4 Kutschräder und einen ca. 100kg schweren Motor, der mit 400 Drehungen pro Minute vor sich hin tuckerte. Diese Motorkutschen waren ca. 300kg schwer, wurden mit einem Schwungrad gestartet, hatten 1 Liter Hubraum mit nur einem Kolben und fuhren für damalige Verhältnisse aufregende 16 km/h.

Nach der zu Beginn zähen Entwicklung des Automobils, folgte bald rasant ein Schritt dem anderen. Schon um die Jahrhundertwende saß der Fahrer im rollenden Auto, der Motor wurde meist vorne eingebaut, beide Achsen wurden gebremst und Luftreifen gehörten bald zur Grundausstattung. Anfang des 20. Jahrhunderts realisierte Robert Bosch die Hochspannungszündung, die den Explosionsmotor noch weiter voranbringt. Kurz darauf baute Spyker in Holland das erste Auto mit Allradantrieb.

Nach der anfänglichen Skepsis wurden die Vorteile des neuartigen Vehikels schnell erkannt. Es konnten längere Strecken bewältigt werden, ohne Pferde austauschen oder ausruhen lassen zu müssen. Der Fahrer musste nur Benzin nachfüllen und schon konnte die Fahrt weitergehen. Vor allem konnten lange Strecken nicht nur einfacher und bequemer zurück gelegt werden, sondern auch schneller. Das Auto vermittelte fort an ein neues Gefühl der Freiheit. Doch die Sicherheitsmängel des Automobils waren lange Zeit gravierend. Zuerst waren es vor allem die Bremsen, die häufig überschätzt wurden und versagten. Mit der Massenproduktion von Autos stiegen auch die Unfallzahlen. Insbesondere dadurch, dass die Infrastruktur noch unzureichend war und Autos, Fußgänger, Reiter und Kutschen die gleichen Wege nahmen. Darüber hinaus gab es weder Vorfahrtsregeln noch Straßenschilder, so dass es an Straßenkreuzungen regelmäßig zu schweren Unfällen kam.

Die Unfallursachen änderten sich mit den Jahren. Durch die Verbesserung der Infrastruktur und die Einführung von Verkehrsregeln passierten weniger Kollisionen an Straßenkreuzungen. Doch durch die unsichere Ausstattung der immer schneller werdenden Fahrzeuge und die Selbstüberschätzung ihrer Fahrer passierten oft tödlich endende Unfälle wegen überhöhter Geschwindigkeit. Den Höhepunkt der Unfallstatistik bildete das Jahr 1970 mit 21332 Verkehrstoten in Deutschland. Erst als 1974 Sicherheitsgurte zur Pflicht in Neuwagen wurden, sanken die Unfallzahlen wieder merklich. Viele Hersteller ignorierten lange Zeit die unzureichende Sicherheit ihrer Produkte. Erst nach und nach wurde das Sicherheitsbewusstsein stärker. Nach der Anschnallpflicht wurden in den 80er Jahren der Airbag eingeführt sowie ABS und ESP entwickelt. Doch diese Entwicklungen und insbesondere die serienmäßige Umsetzung dieser, ziehen sich von Mitte der 70er bis weit in die späten 90er Jahre hinein.

Alongside with safety and infrastructure problems, there was the problem of fuel supply. At the start of motorisation, mobility was mainly determined through the supply of energy sources such as mineral oil, electricity, and solid fuel for fuel, battery and steam engines. Due to the fast development of fuel driven engines and cheap oil prices, the need for energy sources quickly became concentrated on the distribution network for fuel and petroleum products. As long as there were no filling stations fuel had to be purchased in pharmacies. It was filled in little bottles sold in small quantities. Around the turn of the century, more selling points for fuel were arranged. Distributors were grocers, hotels, restaurants, forges, and chemists. Unfortunately, the business came along with a big risk. Accidents with ignited fuel during decanting were not rare.

The need for fuel quickly became in great demand could not be handled through common interurban and sea transportation. Around the turn of the century, the fathers of today's oil companies, such as the German Wilhelm Anton Riedemann (co-founder of Standard Oil Deutschland, today Esso) and the brothers Samuel (founders of Shell), built the first fuel boat fleets. As a result, transport costs could be cut in half and more fuel could be transported to the desired place quicker. The prototype of the filling station was presented by Standard Oil in 1917. In the same way as it is today, it was possible to refuel at a filling pump which was protected from rain and wind by a roof. A pillar displayed the current price and it was paid in a separate box office. However, people weren't required to refuel themselves; there was an employee to attend to the customers. 10 years after the introduction in the US, in August 1927, it was possible to refuel in Hamburg. Even then, different kinds of fuel were offered. In 1924, a super benzine fuel with the addition of 40% benzol was available. With this fuel, engines were less prone to knocking. In 1930, the legally required addition of potato alcohol led to discussion. As it is today with E10, drivers back then were scared of engine damage.

The meaning of the automobile, the literally autonomous movement, brought a new awareness of life to the people. Life became easier, faster, with more freedom and more international. People of all ages had the possibility to be mobile. It was a status symbol and at the same time an invaluable workhorse.

During the last 125 years, more than 2.4 billion passenger cars were produced in the world. But the triumph of the car brought new problems. The emission of air pollutants caused smog in areas of high individual mobility. The high concentration of pollutant in the air led to a ban on driving for the first time in 1985 in Ruhr (industrial area in Germany). Starting in 1989, the catalytic converter became mandatory for cars; further developments are the diesel particulate filter and the aggravation of emission standards. Despite those improvements, pollutant emissions increased due to the continuously growing number of registrations. Even 30 years ago, experts found the pollutant concentration to be too high, and even now we are a long way from reaching sustainable mobility. At the beginning of motorisation there were already cars with electric drives. The current idea of alternative drive concepts such as hybrid or electric engines already existed at the beginning times of the automobile development. In 1899, Belgian race car driver Camille Jenatzy

Neben den Sicherheits- und infrastrukturellen Problemen, gab es zu Beginn noch das Problem der Benzinversorgung. Zu Anfang der Motorisierung wurde die Mobilität vor allem durch die Versorgung mit Energieträgern wie Mineralöl, Elektrizität und Festbrennstoffen für die führenden Benzin-, Batterie- und Dampfmotorkutschen bestimmt. Durch die schnellere Entwicklung benzinbetriebener Motoren und den günstigen Ölpreis, konzentrierte sich der Bedarf an Energieträgern jedoch rasch auf das Vertriebsnetz für Benzin und andere Mineralölprodukte. Doch solange es keine Tankstellen gab, musste Benzin in Apotheken erstanden werden. Es wurde in kleinen Flaschen abgefüllt und in geringen Mengen verkauft. Erst um die Jahrhundertwende wurden weitere Verkaufsstellen für Kraftstoffe eingerichtet. Lieferanten waren nun Kolonialwarenhändler, Hotels, Gaststätten, Schmieden und Drogerien. Leider war es ein Geschäft mit großem Risiko, denn Unfälle mit entzündetem Benzin beim Umfüllen waren keine Seltenheit.

Schon bald konnte der Bedarf an Kraftstoff nicht mehr durch die gängigen Überland- und Seetransporte bedient werden. Um die Jahrhundertwende bauten die Väter der heutigen Mineralölkonzerne, wie der Deutsche Wilhelm Anton Riedemann (Mitbegründer von Standard Oil Deutschland, heute Esso) und die Gebrüder Samuel, den Gründern von Shell, die ersten Tankdampferflotten auf. Dadurch konnten die Transportkosten halbiert und mehr Kraftstoff schneller zum gewünschten Ort transportiert werden. Der Prototyp der Tankstelle wurde 1917 von Standard Oil of Indiana präsentiert. Wie heute konnte an Zapfsäulen durch ein Dach vor Regen und Wind geschützt, getankt werden, eine Preissäule zeigte den aktuellen Preis und gezahlt wurde in einem separaten Kassenhäuschen - allerdings musste man nicht selber tanken, es gab stets einen Angestellten, der die Kunden vor Ort bediente. 10 Jahre nach der Einführung in den USA, im August 1927, konnte in Hamburg zum ersten Mal durch einen Füllrüssel nach amerikanischem Vorbild getankt werden. Schon zu jener Zeit wurden unterschiedliche Benzinarten angeboten. Bereits 1924 gab es ein klopffesteres Superbenzin, das durch Beimischung von ca. 40 Prozent Benzol gewonnen wurde. Zu Diskussionen führte 1930 die gesetzlich vorgeschriebene Beimischung von Kartoffelspiritus. Wie heute bei E10, hatten auch damals die Autofahrer Angst vor Motorschäden.

Die Bedeutung des Automobils, der wörtlich selbständigen Bewegung, brachte den Menschen ein neues Lebensgefühl. Das Leben wurde einfacher, freier, schneller und internationaler. Ältere und behinderte Menschen machte es mobiler, junge Menschen freier. Es war gleichzeitig Statussymbol und schleppendes Arbeitstier.

In den letzten 125 Jahren wurden weltweit mehr als 2,4 Milliarden PKW produziert. Mit dem Siegeszug des Autos gehen jedoch auch Probleme einher. Der Ausstoß von Luftschadstoffen führt in Gebieten hoher individueller Mobilität zu Smog. Die hohe Schadstoffkonzentration in der Luft führt 1985 zum ersten Mal zu Fahrverboten im Ruhrgebiet. Ab 1989 wird der Katalysator in Autos Pflicht, weitere Entwicklungen sind der Dieselpartikelfilter und die Verschärfung der Abgasnormen. Trotz dieser Verbesserungen, nimmt der Schadstoffausstoß durch die ständig wachsende Anzahl an Zulassungen weiter zu. Schon vor 30 Jahren stellten Fachleute eine zu hohe Schadstoffkonzentration in der Luft fest, left the smelly and rattling combustion cars behind with his electric car. As early on as in 1900, Ferdinand Porsche presented his first fuel electro hybrid at the world exhibition in Paris. Power amplifying combustion engines were first established after the turn of the century.

The automobile has experienced a lot of development within the last 125 years. Vehicles have become safer, faster, and more efficient, they exist in many sizes and colours, and they include the most modern technologies. The use of fossil fuels to provide energy for the drive-train is the most definite similarity compared to the first automobiles. New developments include the use of a combination of electric and combustion engines in hybrid cars. Since the end of the 90s, Toyota and Honda have sold millions of hybrid cars. Nowadays other automobile manufacturers are building cars with alternative drive train concepts. The current politics are promoting the development of electric cars and offering them a second chance. In Germany, the automotive industry is one of the most important sectors. For this reason, the education of prospective engineers must react to the reorientation of the automotive industry. In order to live up to this requirement, the organisers of Formula Student Germany made the decision to expand the competition by the addition of a branch for electric cars at an early stage - Formula Student Electric. Here, future engineers obtain the possibility to deal with electric drive trains from an early stage during their education so that theoretically as well as practically trained young engineers can start their professional careers after finishing their degree. In this way, organisers of Formula Student Germany are helping to support our (economic) future.
After the first worldwide and very successful Formula Student Electric competition in 2010, other international Formula Student competitions have adopted the rules and standards of Formula Student Electric. We are proud of this courage and openness and we are confident that the future of the automobile industry as well as Europe's corporate mobility can be approached together. The automobile has formed our society vitally and will continue to do so in the future.

bis zu einer nachhaltigen Mobilität ist es aber auch heute noch ein weiter Weg. Zu Beginn der Motorisierung gab es bereits Fahrzeuge mit elektrischen Antrieben. Der aktuelle Gedanke an alternative Antriebsmethoden, wie Hybrid- und Elektromotor, waren auch schon zu den Anfangszeiten des Automobils vorhanden. 1899 hängte das Elektromobil des belgischen Rennfahrers Camille Jenatzy die stinkenden und knatternden Benzinbetriebenen Fahrzeuge ab. Bereits 1900 präsentierte Ferdinand Porsche auf der Weltausstellung in Paris seinen ersten Benzin - Elektrohybrid. Doch die leistungsstärkeren Verbrennungsmotoren setzten sich nach der Jahrhundertwende durch.

Das Automobil hat in den letzten 125 Jahren viele Entwicklungen erlebt. Die Fahrzeuge sind sicherer, schneller und effizienter geworden, es gibt sie in vielen Größen und Farben sowie mit der modernsten Technik. Die Nutzung fossiler Rohstoffe zur Bereitstellung der Energie für den Antrieb ist die deutlichste Gemeinsamkeit zu den ersten Automobilen der Welt. Neuere Entwicklungen sind die Nutzung einer Kombination aus Elektro- und Verbrennungsmotor in Hybridfahrzeugen. Seit dem Ende der 90er Jahre haben Toyota und Honda Millionen Hybridfahrzeuge verkauft. Mittlerweile bauen auch andere Automobilhersteller Fahrzeuge mit alternativen Antriebskonzepten. Insbesondere der gegenwärtige politische Wille bietet der Entwicklung von Elektrofahrzeugen eine zweite Chance. In Deutschland ist die Automobilindustrie einer der wichtigsten Industriezweige. Aus diesem Grund muss die Ausbildung der Ingenieure von morgen ebenfalls auf die Umorientierung der Automobilindustrie reagieren. Um diesem Anspruch gerecht zu werden, haben die Organisatoren der FSG sich schon frühzeitig überlegt die Formula Student Germany um einen Wettbewerb mit Elektromotoren zu erweitern, der Formula Student Electric (FSE). Hier wird angehenden Ingenieuren die Möglichkeit gegeben, sich bereits während ihres Studiums mit Elektroantrieben auseinander zu setzen, so dass theoretisch wie praktisch ausgebildete junge Ingenieure nach ihrem Abschluss in das Berufsleben entlassen werden. Auf diese Weise unterstützen die Organisatoren der Formula Student Germany unsere (wirtschaftliche) Zukunft.

Nach der weltweit ersten und sehr erfolgreichen FSE, haben andere internationale Formula Student Wettbewerbe das Reglement der FS Electric übernommen. Wir freuen uns über diesen Mut und diese Offenheit und sind zuversichtlich so die Zukunft der Automobilindustrie und die gesellschaftliche Mobilität Europas gemeinsam anpacken zu können. Das Automobil hat unsere Gesellschaft und Welt entscheidend geprägt und wird dies auch in Zukunft tun.

The night-endurance of the worldwide first Formula Student Electric in 2010.
Der Night-Endurance bei der weltweit ersten Formula Student Electric in 2010.

THE VOLUNTEERS OF FSG
DIE EHRENAMTLICHEN DER FSG

Putting their heart and soul in it!

Visitors, participating students, technical press and experts from the automobile and supplying industries are often not aware that the organization of Formula Student Germany is mastered by volunteers united as the Formula Student Germany e.V.. Volunteers, which are unavailable at times and still apply all their energy and passion to live up to their own as well as external expectations. For this reason, the volunteers work on preparing the competition all year so as to ensure a smooth operation during the competition week in August.

But what does it mean to actually be a member of the organizing committee? How much commitment and work is behind it?

What motivates the volunteers year over year to get involved? All these questions are to be answered in the following:

Formula Student Germany e.V. is structured like a company. It consists of a board, an executive committee, and an operational team. Despite this three-stage hierarchic formation, communication lines are kept as short as possible and volunteers associate with each other independent of their

Mit Herzblut, Leidenschaft und Spaß!

Besucher, teilnehmende Studierende, Fachpresse & Fachleute aus der Automobil- und Zulieferindustrie wissen oft nicht, dass die Organisation der Formula Student Germany auf den Schultern von Ehrenamtlichen lastet, zusammengefasst unter dem Dach des Formula Student Germany e.V. Freiwillige, die nicht dauerhaft erreichbar sind und sich doch mit all ihrer Energie und Leidenschaft für die Sache einsetzen, um den eigenen sowie den Ansprüchen von außerhalb gerecht zu werden. Aus diesem Grund arbeiten die Freiwilligen das ganze Jahr über daran, den Wettbewerb vorzubereiten, damit in der entscheidenden Woche im August eines jeden Jahres, alles reibungslos abläuft.

Doch was bedeutet es eigentlich ein Mitglied des Organisationskomitees der FSG zu sein? Wie viel Einsatz und Arbeit steckt dahinter? Welche Motivation treibt sie an sich Jahr für Jahr zu engagieren? All diese Fragen sollen nun beantwortet werden.

Der Formula Student Germany e.V. ist aufgebaut wie ein Unternehmen. Es gibt ein Board, ein Executive Commitee und ein Operational Team. Obwohl hier drei hierarchisch gegliederte Ebenen genannt werden, so versuchen alle die Wege kurz zu halten, Unterschiede im Umgang miteinander durch die jeweilige Positionierung gibt es nicht. Menschlich steht jeder auf der gleichen Stufe und alle gehen miteinander respektvoll um. Für jeden Bereich der Formula Student Germany gibt es bestimmte Arbeitsgruppen. Die eine Gruppe ist für die Konzipierung und Ausführung der statischen Events verantwortlich, ein anderes Team für die dynamischen Events, wiederum andere kümmern sich um die Organisation des Auf- und Abbaus, es gibt ein Team, dass sich um die Kommunikation und Belange der Sponsoren kümmert, wiederum andere übernehmen die Öffentlichkeitsarbeit und so weiter. Selbstverständlich kommt es in jedem ausführenden Team zu Schnittstellen mit anderen Arbeitsgruppen, so dass alle miteinander kooperieren müssen. In der Regel funktioniert positioning. Everybody is put at the same level as a person and treats each other respectfully. There are different working groups for each area of Formula Student Germany. One group is responsible for conception and realization of the static disciplines, another group organizes the dynamic disciplines, another group handles the work plan for site assembly and disassembly, a team is concerned with the sponsors, a team handles public relations and so on. As a matter of course, there are interfaces between the working groups which make close collaboration essential. Generally, this works very well although the individual team members and teams do not meet up very often as they live in different cities or even countries. Thanks to modern means of communication, such as email, Skype, and other communication platforms, most upcoming issues can be discussed via phone or online conference calls and later finalized in the individual home offices. From the beginning, this approach was followed, as good communication and mutual reliability are indispensable for target-oriented work.

Most of the volunteers put a lot of time and effort into the Formula Student Germany project. Before rules and standards for the competition can be established, extended, or improved, different proposals must not only be discussed but also tested. Therefore, it takes expert knowledge as well as lots of time. For instance, the volunteers responsible for the dynamic disciplines often develop technical devices which are needed especially for the FSG as available and rentable equipment is not satisfactory or adequate. An example is the Energy Meter, which 2nd edition is employed this year, or the time measurement. On the other hand, judges and sponsors must be acquired which requires a lot of traveling and time. In order for the competition to be noticed by the general public, the public relations team works to capacity all year round. Although the competition takes place during one week in August, preparations are in progress throughout the entire year.

Most of the FSG participants are employed full time in “real” life. While others enjoy their leisure time after work or at the weekend, the volunteers clarify some technical details at the shop, discuss new ideas for the event on the phone, or they compose articles at the computer. “Why am I doing this? Several people ask me that.”, Tim Hannig, member of the FSG e.V. board, says. “We are all doing it by passion. Many of us were a member of a team ourselves; others got carried away through watching. We are glad to provide prospective engineers the opportunity to reduce their theoretical knowledge into practice. By means of this competition, they can learn so much. They learn how a car is built, how to work within a team, and how to deal with potential

dies sehr gut, obwohl sich die einzelnen Teammitglieder und Teams nur selten sehen. Doch dank moderner Kommunikationsmittel, wie E-Mail, Skype und weiterer Kommunikationsplattformen können die meisten anstehenden Dinge per Telefon oder online in einer Konferenz besprochen und dann im Home Office abgearbeitet werden. Von Beginn an wurde auf diese Weise verfahren, da für eine zielgerichtete Arbeit eine gute Kommunikation und gegenseitige Verlässlichkeit unabdingbar sind.

Die meisten der ehrenamtlichen Mitarbeiter stecken viele Stunden harter Arbeit in das Unterfangen Formula Student Germany. Bevor ein Reglement für den Wettbewerb aufgestellt, ausgeweitet oder verbessert werden kann, müssen verschiedene Vorschläge nicht nur diskutiert, sondern auch erprobt werden. Hierzu ist nicht nur Sachverstand, sondern auch viel Zeit gefragt. Beispielsweise entwickeln die Ehrenamtlichen, die für die dynamischen Wettbewerbe zuständig sind, oftmals eigene technische Geräte, die ganz speziell für die FSG gebraucht werden, da sie mit dem vorhandenen und mietbaren Equipment nicht zufrieden sind oder dieses für die Belange des Wettbewerbs nicht ausreicht, Beispiele hierfür sind das Energy Meter, das es in diesem Jahr in der 2. Auflage gibt, oder die Zeitmessung. Auf der anderen Seite müssen Juroren und Sponsoren geworben werden, hier ist ebenfalls viel Reisetätigkeit und Zeiteinsatz gefragt. Damit der Event auch in einer breiten Öffentlichkeit wahrgenommen wird, läuft die Öffentlichkeitsarbeit ebenfalls das ganze Jahr über auf Hochtouren. Der Wettbewerb mag zwar „nur“ eine Woche im August stattfinden, die Arbeit dafür läuft jedoch über ein ganzes Jahr.

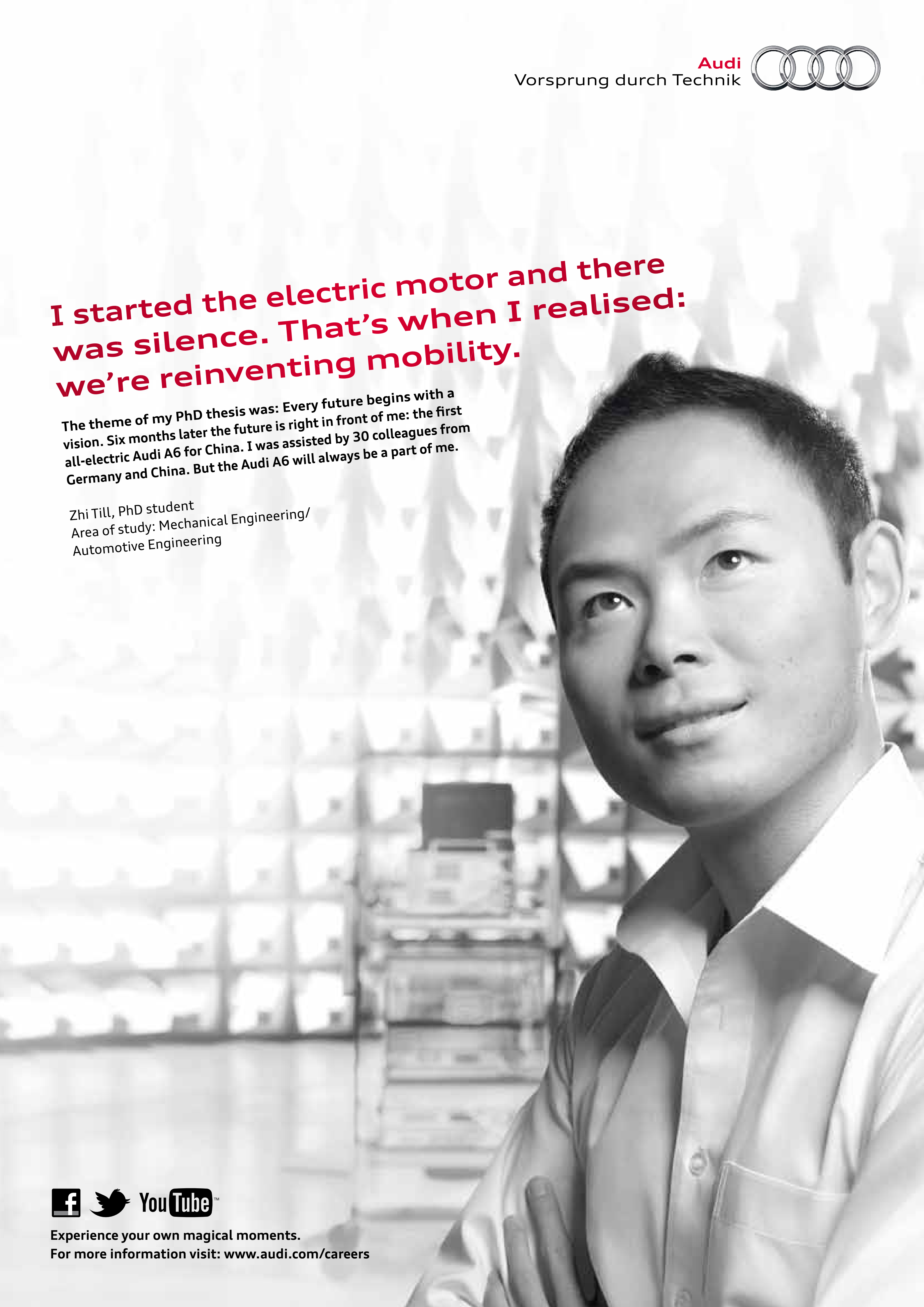
Die meisten bei der FSG Mitwirkenden sind in ihrem „normalen“ Leben Vollzeit berufstätig. Für sie heißt das, wenn andere am Wochenende oder nach Feierabend die Freizeit genießen, ab in die Werkstatt, um noch ein paar technische Details zu klären, ab ans Telefon, um die neuen Vorschläge für einen Wettbewerb zu klären oder ab vor den Computer, um einen Artikel zu verfassen. „Warum ich das mache? Das fragen mich so einige“, sagt Tim Hannig Mitglied des FSG e.V. Vorstands. „Wir alle machen das aus Leidenschaft. Viele von uns waren selbst einmal Teammitglieder, andere hat die Leidenschaft nur durch das Zuschauen gepackt. Wir freuen uns angehenden Ingenieuren eine Möglichkeit zu geben ihr theoretisch erworbenes Wissen praktisch einzusetzen. Durch diesen Event können sie so viel lernen. Sie lernen, wie ein Auto gebaut, in einem Team gearbeitet, mit potentiellen Sponsoren und möglichen zukünftigen Arbeitgebern umgegangen wird. Auf diese Weise können wir ihnen helfen

sponsors and possible prospective employers. This way, we can help them to prepare themselves for their professional career and to get some contacts for their future career. We can challenge and advance them. That is the objective of the Formula Student and the objective of each volunteer. Furthermore, we all have fun with it!" Thus, applying the free time is no burden; otherwise the volunteers would not do it. Naturally, it can become too much at times, especially right before the competition, when work is done day and night, the phone does not stop ringing, and the professional activities have to be pursued "along the way". It is actually like this: During this time, many volunteers rather work for the event than for their own living. Additionally, some precious vacation days must be sacrificed for the competition so that the extensive preparations can be employed successfully as well as enjoyed. It is worth it in the end as the passion and fun make up for it.

Fun is also an important factor. It is not only the objective to advance the students which drives the volunteers but also fun plays a big role. It is a pleasure to organize the competition, to encounter so many different people and nationalities. "Formula Student is like a huge family. Everybody is excited before the competition, right after, one may dislike each other, since it was exhausting, but it does not work without the family", says Daniel Mazur, Event Manager of the FSG. The competition not only creates an atmosphere of family relationships, but also seems like a little world separated from the outside world. People outside of this world can often not understand why someone engages in this project and how it is possible to develop such a passion. During the competition, it appears as if participants and organizers often forget about the outside world, as they barely notice what happens "outside". After returning to "normality", many are surprised what all has happened. Whether earth quakes or a break-in to the supermarket, all events pass by: also in the era of the internet. For many, it is an odd feeling to leave the Formula Student family after one week and go back to their daily routine. To be honest, most participants are too exhausted after the competition to return to the daily work, since they usually worked more the 16 hours per day to make the competition work. Then, they need "real" vacation to relax and go about the preparations for the next year. It must be remembered: after this event begins the preparation for the next event!

sich auf ihr berufliches Leben vorzubereiten und Kontakte für ihre Karriere zu knüpfen. Wir können sie fordern und fördern. Das ist das Ziel der Formula Student und das Ziel eines jeden ehrenamtlichen Mitarbeiters. Außerdem haben wir alle Spaß daran!" Der Einsatz der persönlichen Freizeit ist also keine Last, ansonsten würden die ehrenamtlichen Mitarbeiter dies nicht machen. Selbstverständlich wird es dem ein oder anderen ab und zu mal zu viel, insbesondere so kurz vor dem Event, wenn Tag und Nacht nur noch dafür arbeitet wird, das Telefon nicht still steht und man dann noch „nebenbei" seiner normalen beruflichen Tätigkeit nachgeht. Es ist tatsächlich so: In dieser Zeit arbeiten viele eher für den Event als für seinen eigenen Lebensunterhalt. Hinzu kommt, dass für den Wettbewerb an sich auch ein paar kostbare Urlaubstage geopfert werden, damit die monatelange Arbeit auch erfolgreich umgesetzt und genossen werden kann. Doch was macht man nicht alles für die Leidenschaft und den Spaß, den man dabei hat.

Spaß ist ebenfalls ein wichtiger Faktor. Nicht nur das Ziel die Studenten zu fördern treibt die Ehrenamtlichen an, sondern auch der Spaß an der ganzen Sache spielt eine große Rolle. Es macht einfach Freude den Wettbewerb auszurichten, mit so vielen verschiedenen Menschen und Nationalitäten in Berührung zu kommen. „Die Formula Student ist wie eine riesige Familie. Vor dem Event freuen sich alle, kurz nach dem Event kann man sie manchmal gar nicht leiden, weil sie einen ganz schön erschöpft hat, aber ohne sie geht es gar nicht", sagt Daniel Mazur Event Manager der FSG. Doch der Wettbewerb schafft nicht nur eine Atmosphäre der Familienzugehörigkeit, sondern erscheint auch wie eine eigene kleine von der Außenwelt abgeschottete Welt. Menschen, die sich außerhalb dieser Welt befinden, können oft nicht nachvollziehen, wieso man sich so dafür einsetzt und wie es möglich ist eine solche Leidenschaft zu entwickeln. Während des Wettbewerbs kommt es einem so vor, als ob Teilnehmer und Ausrichter oft vergessen, dass es noch eine Welt außerhalb gibt, denn was während dieser 5 Tage „draußen" passiert bekommen sie kaum mit. Nach der Rückkehr in die „Normalität" sind viele erst einmal verwundert was so alles geschehen ist. Ob Erdbeben oder Einbruch im Supermarkt, all diese Ereignisse gehen an einem vorbei: auch im Zeitalter des Internets. Für viele ist es schon ein seltsames Gefühl, nach einer Woche die Formula Student Familie wieder zu verlassen und in den Alltag einzutauchen. Um ehrlich zu sein, sind die meisten nach dem Event viel zu erschöpft wieder zur alltäglichen Arbeit zurück zu kehren, denn sie haben oft mehr als 16 Stunden am Tag dafür gearbeitet, dass der Wettbewerb läuft. Jetzt brauchen sie erst einmal „richtigen" Urlaub, um sich zu erholen und dann schon die Vorbereitungen für das nächste Jahr in Angriff zu nehmen. Denn nach dem Event ist vor dem Event!


Audi
Vorsprung durch Technik
I started the electric motor and there was silence. That's when I realised: we're reinventing mobility.
The theme of my PhD thesis was: Every future begins with a vision. Six months later the future is right in front of me: the first all-electric Audi A6 for China. I was assisted by 30 colleagues from Germany and China. But the Audi A6 will always be a part of me.
Zhi Till, PhD student
Area of study: Mechanical Engineering/ Automotive Engineering
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DANGERS OF ELECTRICAL SYSTEMS

Electric vehicles are becoming more and more important in the public eye, and while there are many advantages to these systems, the dangers are very prevalent as well. It is important to understand that the dangers of electric cars are not necessarily greater than those of combustion cars, but obviously very different. This article will attempt to shed some light on the dangers of electricity. It will examine the effects of electricity on the human body, discuss general safety measures for working with electrically powered vehicle systems, and provide recommendations for safety measures with respect to vehicle operation.

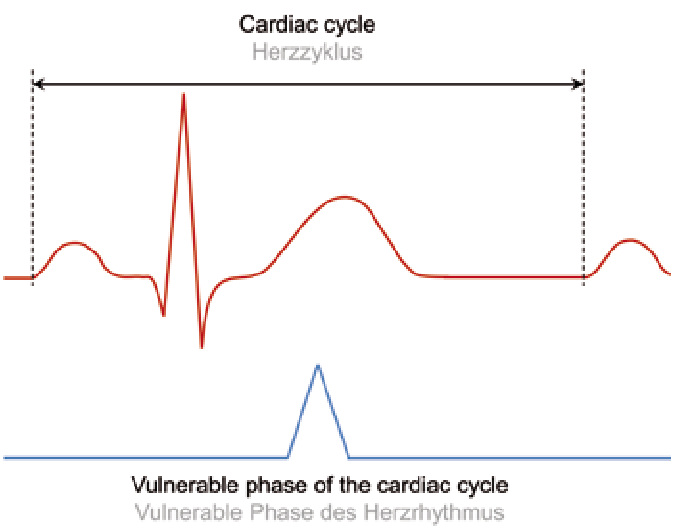
The most important point to remember when discussing the dangers of electricity is that it's always the current that harms the body - never the voltage. Everyone is able to withstand an electric shock of 100.000V as long as the current is several µA or less. Furthermore, there are important differences between alternating current (AC) and direct current (DC).

The effects of electricity on the human body

Several effects of electricity on the human body can be distinguished:

- Primary effect of a disruption to the nervous system
- Secondary effect of a disruption to the nervous system
- Burns

PRIMARY EFFECTS: The nervous system employs low voltages and currents to control the functions of the body, especially muscular contractions. If voltage is applied to the human body causing a current greater than the internal control currents, the nervous system loses muscle control. The affected muscle could be the heart, leading to ventricular fibrillation, or any other muscle, resulting in temporary paralysis in case of AC.
AC voltage is very dangerous, especially within the 50-60Hz range (usually used in the power grid). In case of contact,



Source / Quelle: Peter Sonntag, AUS DER TECHNIK-REDAKTION, Wirkungen des elektrischen Stromes auf Menschen und Nutztiere, Verlag Europa-Lehrmittel, 2008

GEFAHREN ELEKTRISCHER SYSTEME

Elektrofahrzeuge nehmen in der öffentlichen Wahrnehmung eine immer größere Bedeutung ein, und während die Vorteile dieser Konzepte offensichtlich sind, gehen von diesen doch auch Gefahren aus. Dennoch ist es wichtig zu verstehen, dass die Gefahren von Elektroautos nicht notwendigerweise größere sind, als die von Verbrennerfahrzeugen, sondern lediglich sehr verschieden. Dieser Artikel versucht die Gefahren, die von Elektrizität ausgehen können ein wenig zu beleuchten. Dazu werden der Effekt von Elektrizität auf den menschlichen Körper betrachtet, allgemeine Sicherheitsmaßnahmen für den Umgang mit elektrisch angetriebenen Fahrzeugen vorgestellt, wie auch Sicherheitsmaßnahmen, die beim Betrieb der Elektrofahrzeuge berücksichtigt werden sollten.

Bei der Diskussion um die Gefahren von Elektrizität muss bedacht werden, dass es immer der Strom ist, der den Körper schädigt - nie die Spannung. Jeder Mensch ist in der Lage, einen elektrischen Schlag von 100.000V zu ertragen, solange der Strom nur wenige µA oder weniger beträgt. Darüber hinaus gibt es wichtige Unterschiede zwischen Wechselstrom (Alternating Current, AC) und Gleichstrom (Direct Current, DC).

Die Wirkung der Elektrizität auf den menschlichen Körper

Verschiedene Effekte der Elektrizität auf den menschlichen Körper lassen sich unterscheiden:

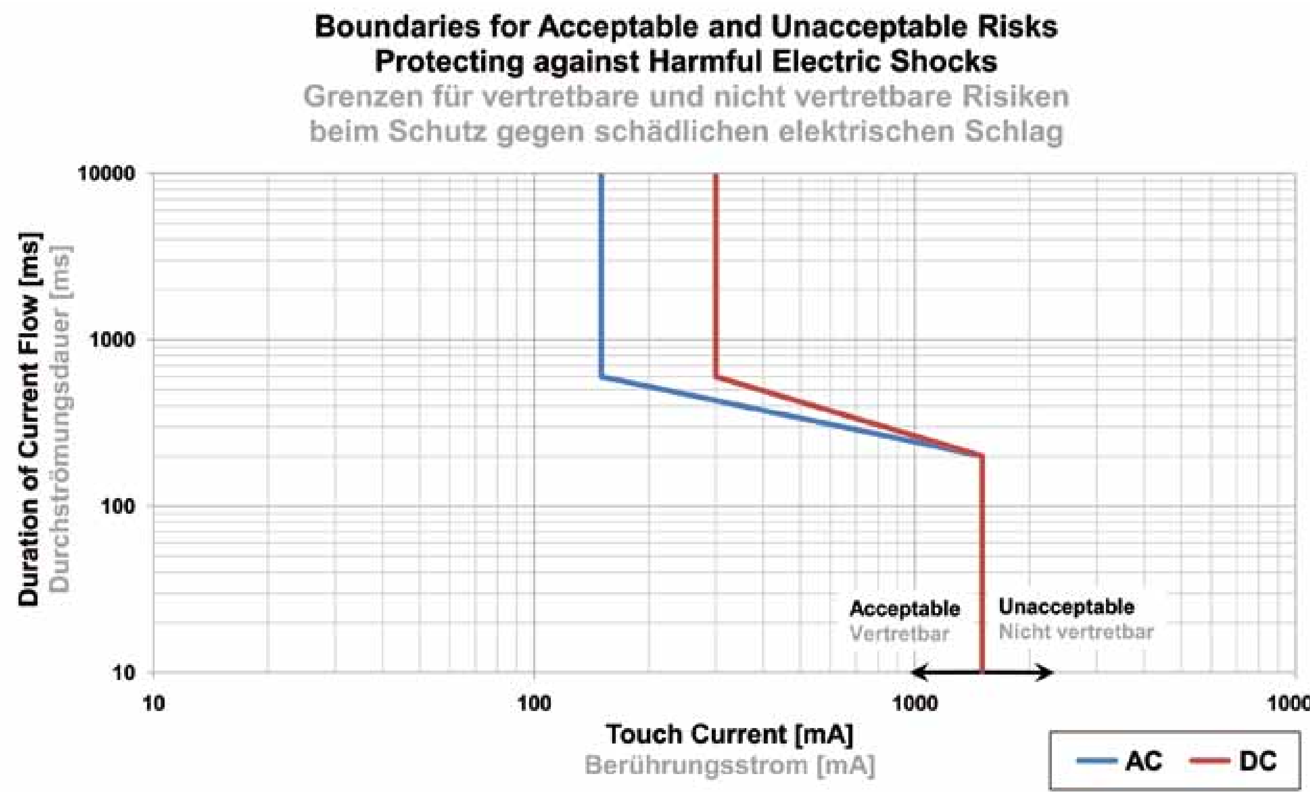
- Primäre Effekte einer Störung des Nervensystems
- Sekundäre Effekte einer Störung des Nervensystems
- Verbrennungen

PRIMÄRE EFFEKTE: Das Nervensystem nutzt geringe Spannungen und Ströme, um die Funktionen des Körpers, vor allem Muskelkontraktionen, zu steuern. Wenn eine an den menschlichen Körper angelegte Spannung Ströme hervorruft, die größer sind als die Ströme des Nervensystems, verliert dieses die Steuerung über die Muskulatur. Der betroffene Muskel kann das Herz sein, so dass es zu Kammerflimmern kommt, oder aber jeder andere Muskel, wodurch vorübergehenden Lähmungen (Krämpfe) enstehen können.

Wechselspannung ist sehr gefährlich, insbesondere im 50-60Hz Bereich, der üblicherweise im Stromnetz verwendet wird. Bei einer Berührung von Wechselspannung kann die Steuerung der Herzmuskulatur durch das Nervensystem durch die oszillierenden Ströme gestört werden, wodurch Kammerflimmern ensteht. Wechselspannung birgt ein größeres Risiko, da sich kontinuierlich die Stromrichtung ändert und dadurch die Wahrscheinlichkeit erhöht wird, dass eine Unterbrechung im kritischsten Teil des Herzzyklus auftritt. Gleichspannung ist weniger gefährlich, da Strom und Spannung nicht die Richtung ändern. Daher muss der Zeitpunkt, in dem der Körper in Kontakt mit der Spannungsquelle tritt, the signals controlling the cardiac muscles may be disrupted by the oscillating currents, leading to ventricular fibrillation. AC poses a greater risk compared to DC due to its continuously oscillating behaviour, thereby greatly increasing the probability that a disruption will occur in the most critical part of the cardiac cycle. DC is less dangerous because its current and voltage do not change polarity. Therefore, the moment the body contacts the voltage source, it has to be timed very specifically with the heart rate for it to be harmful for the cardiac cycle and the probability of this is much lower. However, if the electric shock leads to ventricular fibrillation, no matter whether caused by AC or DC, a defibrillator can be used to recover the cardiac cycle and restart the heart. In this event, the victim in question must be taken to a hospital immediately, even if no obvious effects can be observed. He should then be supervised for at least one day with ECG to ensure that his cardiac cycle is not damaged.

mit einem bestimmten Zustand der Herzfrequenz übereinstimmen, um schädlich für den Herzzyklus sein zu können und ist deshalb weniger wahrscheinlich. In jedem Fall kann bei Kammerflimmern, egal ob von AC oder DC verursacht, ein Defibrillator genutzt werden, um den Herzrhythmus wieder zu normalisieren. Im Anschluß sollte der Verunglückte in einem Krankenhaus untersucht werden, auch wenn keine offensichtlichen Auswirkungen beobachtet werden können. Eine EKG Überwachung für mindestens einen Tag ist angeraten, um sicherzustellen, dass das Herz keinen weiteren Schaden davon getragen hat und es nicht zu weiteren Herzrhythmusstörungen in Folge des Elektrounfalls kommt.

Zur Identifizierung gefährlicher Schwellenwerte für Wechselstrom und Gleichstrom bei denen es zu Herzkammerflimmern kommen kann, sind Versuche durchgeführt worden. Das hier dargestellte Diagramm zeigt den Verlauf der



Source / Quelle:
G. Biegelmeier ÖVE, Elektrotechnik & Informationstechnik (2007) 124/6: 200-208, Das vertretbare Risiko beim Schutz gegen schädlichen elektrischen Schlag für Gleichstrom

To identify dangerous current levels for AC and DC, experiments have been conducted to evaluate the current (both AC and DC) level that could cause ventricular fibrillation. The diagram above shows the border for both AC and DC for acceptable and unacceptable risks leading to ventricular fibrillation. Note the influence of contact duration; the longer the exposure lasts the more dangerous it is. The borders also depend on the current path through the body and have to be adjusted accordingly. The diagram is valid for a hand-to-hand current path.

To determine a voltage level that is able to cause harmful current through the human body, the electrical impedance of the human body has to be taken into account. The diagram below shows the impedance of the human body with respect to the touch voltage assuming dry skin and big contact areas. To illustrate the relationship between the mentioned parameters, a short example will be shown:

The border between low-voltage and high-voltage for FSE cars is defined in the FSE2011 rules as 40VDC. According

Schwellenwerte für Wechselstrom und Gleichstrom, bei denen das Risiko für Herzkammerflimmern als vertretbar eingestuft wird. Besonders wichtig ist, den Einfluss der Kontaktzeit zu beachten: Je länger der Kontakt zur Spannungsquelle andauert, desto gefährlicher ist er. Der Verlauf der Grenze hängt darüber hinaus auch vom Weg des Stroms durch den Körper ab und muss entsprechend angepasst werden. Das hier vorliegende Diagramm gilt für den Stromverlauf von Hand zu Hand.

Zur Berechnung eines Spannungslevels, dass einen schädlichen Stromfluß durch einen menschlichen Körper verursachen kann, muss zusätzlich die elektrische Impedanz (ähnlich des elektrischen Widerstands) des menschlichen Körpers berücksichtigt werden. Das Diagramm (Berührungsspannung) unten auf dieser Seite zeigt die Impedanz des menschlichen Körpers in Abhängigkeit von der Berührspannung unter der Annahme trockener Haut und großer Kontaktflächen. Zur Veranschaulichung der Beziehung zwischen den genannten Parametern, wird ein kurzes Beispiel gezeigt:

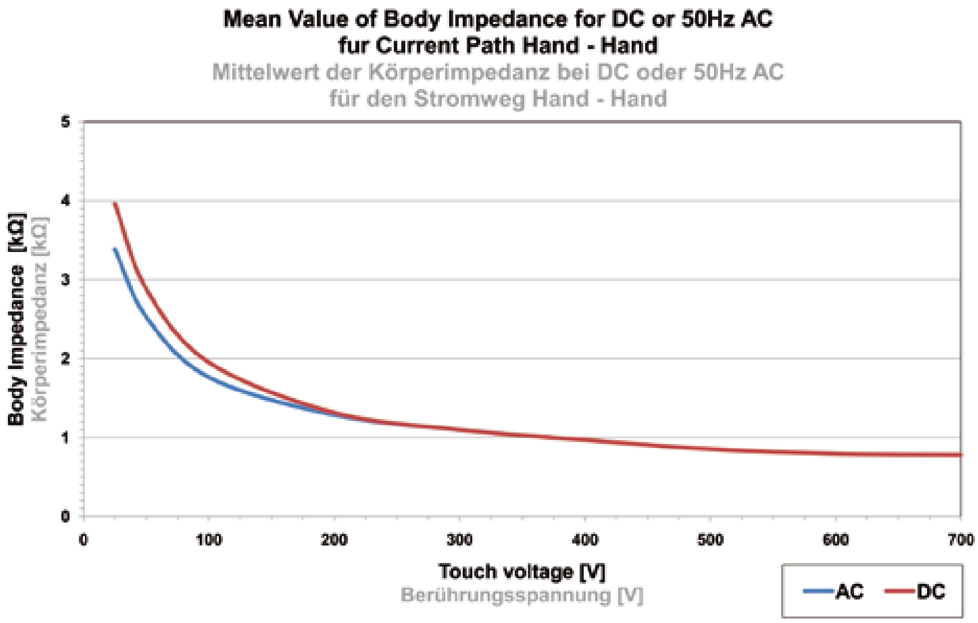
to the diagram below (touch voltage) the body impedance at 40VDC is about 2800 Ohm.
This leads to a current of approx. 40VDC / 2800Ohm = 14mA which is, according to the diagram on the previous page, far from being dangerous to the human body, even if the current persists for a longer time. Therefore no additional safety measures have to be taken into account when working with low voltage systems.

It is also important to mention the likelihood of an electric shock resulting in brain damage. Since current always takes the path with the least resistance, if grounded with the feet while touching a voltage source with a hand, then the current cannot pass through the brain. The current will flow through the arm, across the chest, through the legs and out from the feet.

Another effect can be witnessed when a person touches AC, leading to temporary paralysis. The first step is to disconnect the current or to remove the victim from the voltage source with an insulated material as fast as possible, because of the important influence of current duration (compare diagram on previous page).

SECONDARY EFFECTS: Secondary effects of the disruption of the nervous system include uncontrollable movements. This effect is often underestimated; a victim may fall due to the shock and suffer grievous head injuries. If the victim convulses it may also knock its extremities against hard items nearby. Therefore, it is important to thoroughly check someone after a shock for further injuries.

BURNS: The current running through a body during a shock can cause heavy burns, both externally and internally. As mentioned previously, the current takes the path of the least resistance. Therefore, if someone touches high voltage (HV)+ with the right hand and HV- with the left hand, the current runs straight across the chest, damaging muscles and internal organs. Internal burns are very dangerous since they cannot be treated medically. Furthermore, the skin might burn heavily at the entry and exit points of the current. The amount of current running through your body depends on the voltage, the contact resistance and the resistance of the



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Die Grenze zwischen Nieder-und Hochspannung für FSE Autos, die in den FSE2011 Regeln festgelegt ist, liegt bei 40VDC. Gemäß der hier gezeigten Darstellung (Berührungsspannung) ist die Impedanz des menschlichen Körpers bei 40VDC etwa 2800 Ohm.

Daraus resultiert ein Strom von ca. 40VDC / 2800 Ohm = 14mA, was laut dem Diagramm auf der letzten Seite (Berührungsstrom), weit davon entfernt ist, gefährlich für den menschlichen Körper zu sein, auch wenn der Strom längere Zeit fließt. Deshalb müssen keine zusätzlichen Sicherheitsmaßnahmen berücksichtigt werden bei der Arbeit mit Niedervolt-Systemen.

Es ist ebenfalls wichtig, die Wahrscheinlichkeit einer Hirnschädigung durch einen elektrischen Schlag zu erwähnen. Da Strom immer den Weg des geringsten Widerstandes fließt, würde der Strom durch die Hand, den Körper und die Beine fließen, wenn man eine Spannungsquelle mit der Hand berührt, während man über die Füße geerdet ist; das Gehirn wird nicht durchströmt. Daher sind Hirnschädigungen durch direkte Stromeinwirkungen sehr unwahrscheinlich, da ein Pol der Spannungsquelle mit dem Kopf berührt werden müsste.

Ein weiterer Effekt kann beobachtet, wenn eine Person in Kontakt mit Wechselstrom kommt, wodurch es zu vorübergehenden Lähmungen bzw. Krämpfen kommen kann. Der erste Schritt ist immer, die Spannungsquelle abzuschalten oder das Opfer von der Spannungsquelle so schnell wie möglich mit einem isolierenden Material zu trennen, wegen des entscheidenden Einflusses der Durchströmungsdauer (vgl. Diagramm auf der vorherigen Seite).

SEKUNDÄRE EFFEKTE: Zu den sekundären Effekten bei einer Störung des Nervensystems gehören unkontrollierbare Bewegungen. Dieser Effekt wird häufig unterschätzt; die Opfer stürzen häufig durch den elektrischen Schock und können dabei schwere Kopfverletzungen erleiden. Wenn das Opfer krampft, kann es außerdem seine Extremitäten gegen harte Gegenstände in der Nähe schlagen. Daher ist es wichtig, denjenigen nach einem elektrischen Schlag gründlich auf weitere Verletzungen zu überprüfen, die nicht unmittelbar mit dem elektrischen Schlag zusammenhängen.

VERBRENNUNGEN: Wenn der Strom während eines elektrischen Schlags durch den Körper fließt, kann es zu schweren Verbrennungen kommen, sowohl extern als auch intern. Wie bereits erwähnt, nimmt der Strom immer den Weg des geringsten Widerstandes. Wenn jemand Hochspannung (HV) + mit der rechten Hand und HV-mit der linken Hand berührt, läuft der Strom quer durch den Torso, und schädigt dabei Muskeln und innere Organe. Innere Verbrennungen sind sehr gefährlich, da sie nicht medizinisch behandelt werden können. Darüber hinaus kann die Haut an den Ein- und Austrittspunkten des Stroms stark verbrannt werden.

current path through your body. For instance, having sweaty hands lowers the contact resistance of hands dramatically and a given voltage will now be a lot more dangerous.

General safety measures for working with electrically powered vehicle systems

The major danger with respect to Formula Student Electric (FSE) is the DC voltage of the accumulators. However, if FSE teams use AC motors and measurements are carried out within a motor controller or at the motor(s), AC voltage may be dangerous as well. Therefore the students are advised to integrate several safety measures to minimise the danger for electric shocks into their working procedures.

- It must be ensured that the HV system of the car has been shut down safely and may not be reactivated. Measurements are to be carried out check voltage level after the system has been shut down. There should be no voltage present. These steps must be taken each time work is done on the vehicle.
- No one should ever work alone on the car.
- HV-insulating gloves are to be worn whenever working on the HV system; the gloves are to be disposed after contact with electric arcs.
- Additional safety gear, such as a face shield, must be worn when working with HV.
- All tools are to be rated for the maximum tractive system voltage.
- When planning to work on the electric system of the car, the following steps should be followed:

  1. Shutting down of the system
  2. Protecting it from being activated again (using signs and locking switches)
  3. Measuring for no voltage left in the system.
  (4. Shorting the system. Only applicable, if the system is fused in a way that the fuse will react, if the system is reactivated)
  5. Covering all parts of the system with insulating blankets on which no work is carried out or which may still carry high voltages.

- If someone gets an electric shock, always take them directly to hospital.
- If someone is connected to a voltage source, use something insulated to remove them from that voltage source.

Special safety measures with respect to vehicle operation

To ensure safe operation of the prototype electric vehicle during testing or during Formula Student competitions, students are also advised to adhere to the following:

- At least one qualified Safety Responsible team member should be present to supervise the car's operation.
- All team members should know how to safely shut down the car in case of an emergency. (Function of the shut down buttons, Tractive System Active Light, HV main switch, etc.)

Die Höhe des dabei fließenden Stroms durch den Körper hängt ab von der Spannung, dem Kontaktwiderstand und dem Widerstand des Weges, den der Strom durch den Körper nimmt. Beispielsweise senken verschwitzte Händen den Kontaktwiderstand der Hände stark und eine gegebene Spannung wird durch den reduzierten Widerstand deutlich gefährlicher.

Allgemeine Sicherheitsmaßnahmen für das Arbeiten mit elektrisch betriebenen Fahrzeug-Systemen

Die größte Gefahr in Bezug auf Formula Student Electric (FSE) ist die Gleichspannung des Akkus. Wenn FSE Teams allerdings Wechselstrom-Motoren verwenden und Messungen an der Motorsteuerung oder an den Motoren durchführen, kann auch die gefährlichere Wechselspannung zur Gefahr werden. Deshalb wird den Studierenden empfohlen, mehrere Sicherheitsmaßnahmen in ihre Arbeitsabläufe zu integrieren, um das Risiko elektrischer Schläge zu minimieren.

- Es muss sichergestellt werden, dass das HV-System des Autos abgeschaltet wurde und nicht reaktiviert werden kann. Durch Messungen muss sichergestellt werden, dass keine Spannung im System vorhanden ist, nachdem das System heruntergefahren wurde. Diese Messungen müssen jedes Mal durchgeführt werden, wenn Arbeiten am Fahrzeug erfolgen sollen.
- Niemand sollte jemals alleine am Fahrzeug arbeiten.
- HV-isolierende Handschuhe sollten bei Arbeiten am HV-System getragen werden; die Handschuhe müssen nach Kontakt mit Lichtbögen entsorgt werden.
- Zusätzliche Schutzausrüstung, wie z.B. ein Gesichtsschutz muss getragen werden, wenn am HV-System gearbeitet wird.
- Alle Werkzeuge müssen für die maximale Spannung des Systems ausgelegt sein.
- Vor Arbeiten am elektrischen System des Autos, sollten die folgenden Schritte befolgt werden:

  1. Spannungsfrei schalten
  2. Schutz vor Reaktivierung (durch geeignete Schilder und das Sichern von Schaltern)
  3. Messungen zur Sicherung der Spannungsfreiheit des Systems.
  (4. Kurzschließen des Systems. Nur sinnvoll, wenn das System so durch eine Sicherung abgesichert ist, dass diese bei Wiedereinschalten auslöst!)
  5. Abdeckung aller Komponenten des Systems mit isolierenden Decken, an denen nicht gearbeitet wird oder die möglicherweise noch unter Spannung stehen.

- Wenn jemand einen kritischen elektrischen Schlag erleidet, muss er immer direkt ins Krankenhaus gebracht werden.
- Wenn jemand einen elektrischen Schlag bekommt und danach noch immer mit der Spannungsquelle verbunden ist, sollte ein isolierender Gegenstand verwendet werden, um das Opfer schnellstmöglich von der Spannungsquelle zu trennen

- One team member should always wear HV insulating gloves so that the driver can be immediately rescued in the case of an accident.
- Vital safety systems such as the Insulation Monitoring Device (IMD), shut down buttons, and Tractive System Active Light (TSAL) should be tested before starting the car.
- Should the accumulator start to smoke or catch fire, the driver has to leave the car immediately and keep away from the car! The smoke should not be inhaled.
- Foam extinguishers must not be used for electric fires. Foam conducts electricity and is therefore not suitable.
- CO_2 may be used, but might not be sufficient, especially because they do not cool the cells sufficiently and empty quickly.
- Plenty(!) of water can usually also be used to cool and extinguish a burning cell / accumulator.
- After the tractive system has been activated, no one should stand in front of the car, between the wheels, or behind the car. The car may accelerate without the driver's input due to drive-by-wire.
- The high voltage systems of FSE cars have to be designed to be Isolated Terra (IT)-systems, meaning that ground (HV-) is also a wire and not (as example) the frame of the car. Therefore it is always possible to touch one pole with a bare hand without danger, but this should only be done in an emergency when nobody wearing insulating gloves is available. In this situation it is most important not to touch the car with a second extremity while trying to help the driver.

With all the above mentioned recommended safety measures for working on the car or operating the car, it should be possible for the students to avoid greater damages or risks. Although the above mentioned dangers may seem to be numerous and very risky, they are not much more dangerous than any other car accident that can happen on the streets or the dangers combustion cars pose. It's just that our society is not as used to these potential risks as it is with combustion cars.

Besondere Sicherheitsmaßnahmen in Bezug auf den Betrieb des Fahrzeugs

Für den sicheren Betrieb der prototypischen Elektrofahrzeuge beim Testen oder bei den Formula Student Wettbewerben wird den Studenten empfohlen, die folgenden Punkte zu berücksichtigen:

- Mindestens ein qualifizierter Sicherheitsverantwortlicher (Safety Responsible, SR) muss beim Betrieb des Fahrzeugs anwesend sein.
- Alle Teammitglieder sollten wissen, wie das Fahrzeug im Falle eines Notfalls sicher abgeschaltet werden kann. (Funktion der Notaus-Schalter, Hochspannungswarnlicht, HV Hauptschalter, etc.)
- Ein Teammitglied sollte immer HV-isolierende Handschuhe tragen, so dass er den Fahrer nach einem Unfall retten kann.
- Entscheidende Sicherheitssysteme wie das Isolations-Überwachungsgerät (IMD), Notaus -Schalter, HV Warnlicht (TSAL) sollten vor Fahrbeginn des Fahrzeugs immer getestet werden.
- Sollte der Akku beginnen zu rauchen oder sich entzünden, muss der Fahrer das Auto sofort verlassen, Sicherheitsabstand zum Auto ist einzuhalten. Der Rauch sollte nicht eingeatmet werden.
- Schaumlöscher dürfen nicht für elektrische Brände verwendet werden. Schaum ist elektrisch leitend und daher nicht geeignet.
- CO_2 kann verwendet werden, ist aber möglicherweise nicht ausreichend, vor allem da die Zellen nicht gekühlt werden und der Löscher sich schnell leert.
- Nach dem das Hochspannungswarnlicht aktiviert wurde, sollte niemand vor dem Auto, zwischen den Rädern oder hinter dem Auto stehen. Das Auto könnte ohne Eingaben des Fahrers durch die Drive-by-Wire Funktionalität beschleunigen.
- Die Hochspannungs-Systeme von FSE Autos sind als Isolated Terra (IT)-Systeme zu gestalten. Das bedeutet, dass die Masse (HV-) ebenfalls eine isolierte Leitung ist und nicht etwa der Rahmen des Autos. Bei solchen vollisolierten Systemen ist es immer möglich, einen Pol mit der bloßen Hand ohne Gefahr zu berühren. Dies sollte aber nur im absoluten Notfall erfolgen, wenn niemand mit isolierenden Handschuhen verfügbar ist. In dieser Situation ist es besonders wichtig, das Auto nicht unabsichtlich an einer zweiten Stelle zu berühren, beim Versuch den Fahrer zu bergen.

Mit allen oben genannten empfohlenen Sicherheitsmaßnahmen für die Arbeiten am Auto oder den Betrieb des Autos, ist es für die Studenten ohne Weiteres möglich, größere Schäden oder Gefahren zu vermeiden. Obwohl die oben genannten Risiken zahlreich und sehr riskant zu sein scheinen, sind sie nicht größer als die Risiken normaler Autos im aktuellen Straßenverkehr. Allerdings ist unsere Gesellschaft mit diesen potenziellen Risiken nicht so vertraut, wie bei Verbrennungsautos.

The Pros and Cons of E85

The Formula Student competition is giving engineers more design freedom than any other race car environment. The rules the teams are subjected to are primarily to ensure their safety. This design freedom can be used by teams to come up with creative new ideas making their car just that little bit faster than the cars of the other teams. However, since the average cycle from concept to test is about nine months, this freedom can be your worst enemy if the design process within the team is not well structured. For example, some teams lose too much time on researching different concepts resulting in a car with barely any test kilometers driven, while other teams struggled with the priority resulting for example in a fancy suspension set up without spending time on selecting the right tire. Because of this design freedom and the short period in which the students experience a whole design cycle of a complete car, their learning curve is generally very steep. The instructive experiences gained by designing and building a formula student race car is a challenge to find in your first job.

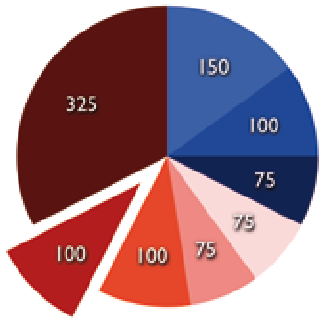
The design of a formula student car starts with the definition of a main goal; for instance winning the FSG 2011 competition. Secondly, it has to be decided if the team will develop an electrically powered car or a combustion-engined car. Let's say a team has decided on building a combustion engine powered car, hence competing in the FS Combustion event. In the next step the team sits together and comes up with a philosophy which global design in their opinion is best to fulfill this main goal: winning FSG 2011. Winning FSG is not simply a matter of being the fastest. Since the Formula Student event comprises many static and dynamic competitions, it will come as no surprise that for almost every of these competitions a different car is best. Therefore trade-offs are made such as: will we develop a power train with maximum power allowed by the rules to increase the chance to score high on the acceleration event, risking drivability issues on the skid pad event and costing points on the fuel efficiency event? Or: should we spend time on developing an ABS braking system, increasing the weight of the car but hopefully improving the performance of our drivers. And what about the tires; should we use the same type as last year, which gave us the fastest lap, but at the risk of hitting more cones?

The above list can obviously be extended with many more areas which influence the design of (almost) the complete car. One of these areas is the fuel type choice. Choosing the fuel type might seem a simple and indifferent choice, but as we will see there is a lot more to it. The rules allow the engineers to choose between different octane ratings of petrol and E85. E85 contains 85% (by volume) ethanol and 15% petrol. Which benefits E85 can have over conventional petrol and why such seemingly small choice has such a high impact on the complete power-train is explained next.

Die Vor- und Nachteile von E85

Im Vergleich zu anderen Rennsportumgebungen haben die zukünftigen Ingenieure bei der Formula Student die größte Konstruktionsfreiheit. Die Regeln nach denen sich die Teams richten müssen, beziehen sich zum größten Teil auf die Sicherheit der Studenten. Diese Freiheit beim Bau des Fahrzeugs kann von den Teams für neue kreative Ideen eingesetzt werden, ihr Fahrzeug noch ein bisschen schneller als das der anderen zu machen. Ohne eine klare und durchdachte Strukturierung des rund neun Monate dauernden Entwicklungsprozesses vom anfänglichen Konzept bis hin zu den Tests, kann die den Teams gegebene Freiheit allerdings auch zu ihrem größten Feind werden. Zum Beispiel verlieren manche Teams zu viel Zeit damit verschiedene mögliche Konzepte für den Bau ihres Rennwagens zu erforschen. Dies führt dazu, dass das Fahrzeug erst sehr spät fertig wird und kaum Testkilometer gefahren absolviert hat. Andere versäumen es Prioritäten zu setzen, so dass sie ein ausgefallenes Fahrwerk entwickeln, ohne dabei die Auswahl des richtigen Reifens zu berücksichtigen. Trotz oder gerade wegen der Konstruktionsfreiheit und der kurzen Zeitspanne, in der die Studenten einen ganzen Fahrzeugentwicklungs- und Herstellungszyklus erleben und kennenlernen, erfahren sie eine sehr steile Lernkurve. Diese Erfahrungen, die sie durch die Konstruktion und den Bau eines Formula Student Rennwagens machen, ist eine lehrreiche Herausforderung, die sie in ihrem ersten Job wohl kaum machen werden.

Die Konstruktion eines Formula Student Rennwagens beginnt mit der Definition eines Ziels; zum Beispiel die FSG 2011 zu gewinnen. Zweitens muss entschieden werden, ob das Team ein elektrisch angetriebenes Fahrzeug oder ein verbrennungsmotorisch angetriebenes Fahrzeug bauen möchte. Gehen wir einmal davon aus, dass sich das Team dafür entschieden hat ein Auto mit Verbrennungsmotor zu bauen, das heißt also in der Konkurrenz der Formula Student Combustion antritt. Im nächsten Schritt setzt sich das Team zusammen und überlegt sich welches Konstruktionskonzept ihrer Meinung nach am besten geeignet ist, um ihr Ziel, die FSG 2011 zu gewinnen, zu erreichen. Um die FSG zu gewinnen, reicht es nicht einfach die schnellsten zu sein, da der Wettbewerb aus mehreren statischen und dynamischen Disziplinen besteht. So ist es keine Überraschung, dass für fast jede dieser Disziplinen ein anderes Fahrzeug das Beste ist. Aus diesem Grund müssen beim Bau verschiedene Kompromisse eingegangen werden: werden wir einen Motor mit maximaler erlaubter Leistungsfähigkeit bauen, um die Chance zu erhöhen beim Acceleration Event eine möglichst hohe Punktzahl zu erreichen, was aber beim Skid Pad zu schlechterer Fahrbarkeit führen und beim Wettbewerb der Treibstoffeffizienz Punktverlust führen kann? Oder sollten wir die Zeit investieren ein ABS Bremssystem zu entwickeln und somit das Gewicht des Fahrzeugs erhöhen, aber hoffentlich die Fahrperformance unseres Fahrers verbessert? Und was ist mit den Reifen? Sollten wir den gleichen Typ wie im letzten



Overview of FSG 2011 scoring.
Punkteverteilung bei der FSG 2011.

First of all, if implemented well, E85 can increase the engine efficiency. So the students have to choose whether to increase engine power with the same amount of fuel or to maintain engine power and increase fuel economy. The first option has obvious benefits however the latter option has become more and more interesting over the last years. Two main reasons can be found for this. First of all, since the final scores of the top 10 teams are getting closer to each other, teams have to score well on every static and dynamic event. Secondly, since 2008 the calculation method of the fuel efficiency not only looks at the amount of fuel used, but also takes into account the finish time of the car. Since fast cars generally use more fuel, the fast teams can now also score on the fuel efficiency event.

Why can E85 increase engine efficiency? The first reason is that ethanol cools down the intake air more than conventional petrol as the fuel evaporates in the air intake thereby cooling the air fuel mixture. Since cooler air is denser, more air is drawn into the combustion chamber per stroke. A Formula Student car engine intake when fuelled with E85 can become only a few degrees Celsius above zero when testing on a hot day. A second reason why E85 is more efficient is its combustion behavior. The combustion is faster, resulting in a shorter and higher pressure peak. The shorter combustion time causes less energy to be lost to the cylinder wall and piston, hence more energy is left for propulsion.

At this moment you may wonder why not every team at the competition has switched from petrol to E85; well, there are a number of downsides of using E85 as fuel. First of all the reason why E85 is not simply E100 (100% pure ethanol) already gives one clue. The 15% petrol is added in order to enhance the cold starts, therefore low temperatures cause difficult starts and a decrease in fuel economy. Secondly, to maximize the effect of the above mentioned cooling of E85, the injector has to be placed so far upstream that a second injector may be required in order to ensure a good engine operation at low engine speeds. A third problem often seen with E85 cars is the tendency to backfire due to the large ignition delay when using the "wasted spark" ignition strategy (firing every engine revolution). Petrol cars have far less problems using wasted spark, which is also easier and cheaper to make. Most teams, at least once in their testing phase, will have to rebuild their engine intake after a backfire during engine tuning. Another problem,

Topview onto cracked piston head.
Draufsicht auf einen gerissenen Kolbenboden.

Source / Quelle: DUT Racing

Jahr verwenden, dem wir die schnellste Runde verdanken, was aber auch dazu führen kann, dass wir gegebenenfalls mehr Pylonen umfahren?

Die oben angeführte Liste kann noch um viele weitere Fragen und Probleme erweitert werden, die (fast) die gesamte Konstruktion eines Autos betreffen. Einer dieser Bereiche ist auch die Wahl des Kraftstoffes. Diese Wahl mag einfach und unwichtig erscheinen, doch wie wir im Folgenden noch sehen werden ist dies eine wichtige Frage. Die Regeln erlauben es zwischen den verschiedenen Oktanzahlen von Benzin und E85 zu wählen. E85 beinhaltet 85 Volumen-%Ethanol und 15 Volumen-% Benzin. Welche Vorteile E85 gegenüber konventionellem Benzin hat und warum eine solch scheinbar unwichtige Wahl einen doch so großen Einfluss auf den kompletten Motor hat, wird im Kommenden erläutert.

Wenn E85 richtig eingesetzt wird, kann es die Effizienz des Motors erhöhen. Die Studenten müssen sich also entscheiden, ob sie die Leistungsfähigkeit des Motors mit der gleichen Menge Kraftstoff erhöhen oder ob sie die Leistungsfähigkeit des Motors beibehalten und dafür die Kraftstoffeffizienz erhöhen wollen. Die erste Option hat offensichtliche Vorteile, während die zweite Möglichkeit in den letzten Jahren immer interessanter geworden ist. Hierfür gibt es zwei Hauptgründe: Da die Gesamtpunktzahlen der Top 10 Teams immer näher aneinanderrücken, muss jedes Team, um die Gewinnchancen zu erhöhen, bei jedem statischen und dynamischen Wettbewerb gut punkten. Außerdem wird seit 2009 in der Kalkulationsmethode für Kraftstoffeffizienz nicht nur die Menge des Kraftstoffverbrauchs, sondern auch die Zielzeit des Fahrzeugs betrachtet. Da schnelle Autos in der Regel mehr Kraftstoff verbrauchen, können die schnellen Teams hier nun auch beim Wettbewerb der Kraftstoffeffizienz punkten.

Warum kann E85 die Motoreffizienz erhöhen? Der erste Grund ist, dass Ethanol die Ansaugluft weiter herunter kühlt als konventionelles Benzin, da der Kraftstoff im Ansaugschacht verdampft und hierbei die Kraftstoff-Luft-Mixtur kühlt. Da kühlere Luft dichter ist, wird pro Kolbenhub mehr Luft in die Brennkammer gezogen. Der Ansaugtrakt eines Formula Student Rennwagens, betankt mit E85, kann an einem heißen Testtag also auf ein paar Grad Celsius über Null abkühlen. Ein weiterer Grund für die erhöhte Effizienz von E85 ist sein Verbrennungsverhalten. Die Verbrennung ist schneller und resultiert in einer kürzeren und größeren Druckspitze. Die kürzere Verbrennungszeit führt dazu, dass an Zylinder und Kolben weniger Energie verloren geht und so mehr Energie für den Antrieb bleibt.

Nach den oben dargestellten Ausführungen scheint es verwunderlich, dass nicht alle teilnehmenden Teams von Benzin auf E85 umsteigen. Doch bei der Benutzung von E85 gibt es auch negative Seiten. Schon allein die Bezeichnung E85 und nicht einfach E100 (100% pures Ethanol) gibt einen Hinweis. Es werden 15% Benzin hinzugegeben, um den Kaltstart zu verbessern, das heißt, dass niedrige Temperaturen zu einem schwierigeren Start führen und somit die Kraftstoffeffizienz verringern. Zweitens, um den oben beschriebenen Kühlungseffekt von E85 zu maximieren, muss die Einspritzdüse weit oben im Ansaugtrakt angebracht werden, dass in manchen Fällen eine zweite Einspritzdüse benötigt wird, um auch bei niedrigen Drehzahlen einen guten Motorenbetrieb zu gewährleisten. Ein drittes Problem, welches sich oft bei which is experienced frequently by E85 cars, is the many premature piston and/or cylinder break downs. Higher combustion pressures and degradation of the engine oil are plausible causes, however many teams do not have the time nor financial means to investigate this key problem extensively. Sticking to petrol has a clear benefit in this respect.

Detailed view of a Formula Student race car's E85 fuel system.
Detailaufnahme einer E85 Kraftstoffanlage eines Formula Student Rennwagens.

Side view of an fuel system of an E85 Formula Student race car.
Seitliche Aufnahme eines Kraftstoffsystems eines E85 Formula Student Rennwagen.

Source / Quelle: DUT Racing

Not only the engine itself is affected by the application of E85, but additionally the fuel system needs to be constructed from different materials when using E85. Rubber o-rings and aluminum parts for example should be avoided, especially for parts which are in constant contact with E85 such as the fuel tank because the ethanol corrodes or mellows some materials as for instance aluminum or plastics. The fuel tank also has to be enlarged due to the lower energy content of the fuel, causing the need to carry more fuel to drive the same distance.

As can be seen, such a seemingly minor decision as the fuel type has huge implications on the total power train design. As can be read above, students need to redesign almost every part of the power train if a team decides to select E85 over petrol. The team needs to estimate in advance if all the extra effort, the money spent and increased risk of failure of petrol to E85 conversion is worth the gain. This will be clear not only at the dynamic events, but also when the design judges require a well balanced explanation why the team chose to fuel its engine with E85, especially since the engine is originally designed for petrol by the OEM (Original Equipment Manufacturer).

Therefore, although E85 has some clear functional benefits over petrol, in the end the balance between points gained at the dynamic and static events and the costs in terms of reliability and needed manpower needs to be made carefully. However if for whatever reason in the end this balance appears to be negative, the students still have increased their knowledge considerably during the design of their car, often supplemented with knowledge gained by talking to other teams and design judges during the FSG event.

Fahrzeugen äußert, die mit E85 betrieben werden, ist die Tendenz zu Rückzündungen durch den langen Zündungsverzug, wenn die „schwacher Funke" Zündungsstrategie (jede Motorumdrehung wird gezündet) genutzt wird. Benzin betriebene Autos haben weit weniger Probleme einen schwachen Funken zu nutzen, der ebenfalls einfacher und günstiger zu machen ist. Die meisten Teams müssen während ihrer Testphase mindestens einmal nach einer Rückzündung während der Motoreinstellung den Ansaugtrakt ersetzen. Ein weiteres Problem, das oft bei Fahrzeugen auftritt, die mit E85 betankt werden, sind die vielen frühzeitigen Kolben und / oder Zylinderrisse. Ein höherer Verbrennungsdruck und die Degradierung von Motoröl sind hier plausible Gründe, doch haben viele Teams weder Zeit noch Geld um in dieses Schlüsselproblem intensiv zu investieren. Die Wahl von Benzin hat in dieser Hinsicht klare Vorteile.

Nicht nur der Motor ist beim Einsatz von E85 betroffen, auch die Kraftstoffversorgung muss aus anderen Materialien gebaut werden. Gummidichtungsringe und Aluminiumteile zum Beispiel sollten vermieden werden, insbesondere bei Teilen, die in dauerhaftem Kontakt mit E85 stehen, wie dem Kraftstofftank, da das Ethanol bei Aluminium beispielsweise zu Korrosion führen und Plastik mürbe beziehungsweise weich machen kann. Wegen des niedrigeren Energiegehalts von E85 muss der Kraftstofftank vergrößert werden, um die gleiche Distanz fahren zu können.

Wie sichtbar geworden, hat eine solch scheinbar unwichtige Entscheidung, wie die Frage nach dem Treibstoff, doch einen großen Einfluss auf die Konstruktion des gesamten Antriebsstranges. Wie den oben stehenden Ausführungen zu entnehmen ist, müssen die Studenten, wenn sie sich für E85 gegenüber reinem Benzin entscheiden, fast jedes Teil des Motors neu- / um- konstruieren. Das Team muss deshalb vorher abschätzen, ob sich der zusätzliche Aufwand, das Geld und die erhöhte Ausfallgefahr, die durch die Umstellung von Benzin auf E85 entsteht, den potentiellen Nutzen wert sind. Dies wird nicht nur in den dynamischen Disziplinen klar, sondern auch wenn die Design-Juroren nach einer gut ausgewogenen Erklärung fragen, wieso sich das Team dafür entschieden hat sein Fahrzeug mit E85 fahren zu lassen, vor allem, wenn der Motor ursprünglich vom OEM (Originalausrüstungshersteller) für Benzin konstruiert wurde.

Obwohl E85 einige klare Vorteile gegenüber Benzin hat, muss deshalb die Balance zwischen gewonnen Punkten bei den dynamischen und statischen Wettbewerben sowie den Kosten in Bezug auf Verlässlichkeit und Arbeitskraft sorgsam gehalten werden. Selbst wenn sich am Ende herausstellt, dass die Balance nicht gehalten wurde und die Gewichtung ins Negative fällt, so haben die Studenten ihr Wissen während des Baus ihres Fahrzeugs immens erweitert und durch Gespräche mit anderen Teams und Design-Juroren während der FSG 2011 ergänzt.

FSG 2010 - IMPRESSIONS

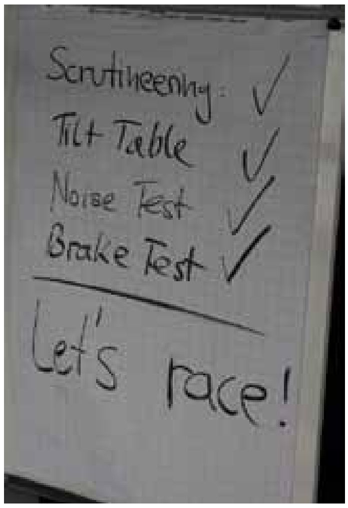
FSG 2010 - IMPRESSIONEN











Scrutineering ✓
Tilt Table ✓
Noise Test ✓
Brake Test ✓
Let's race!









Racecars crossing
High Voltage








FEM

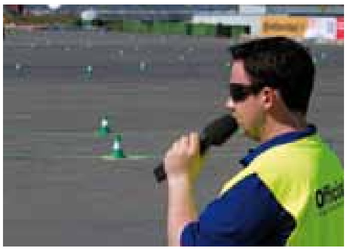












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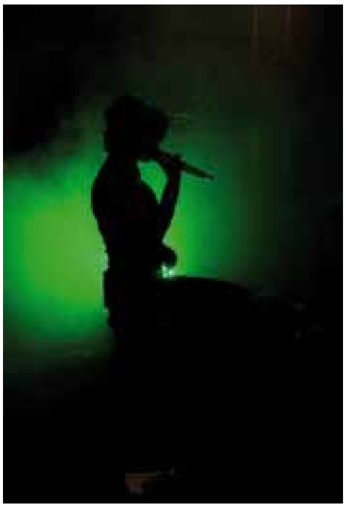
UNI STUTTGART
MAHLE









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More pictures on: media.formulastudent.de

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FRAME CONSTRUCTION CFRP Monocoque with tubular steel roll bars

MATERIAL CFRP

OVERALL L / W / H (mm) 2823 / 1440 / 1059

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1250 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 134 / 164

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper.

TYRES (Fr / Rr) 20.5x7, Hoosier R25B/20.5x7, Hoosier R25B

WHEELS (Fr / Rr) 7x13, -25mm offset, 1pc Al Rim/7x13, -25mm offset, 1pc Al Rim

ENGINE Kawasaki ZX600R-9F

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.3:1

FUEL SYSTEM Student designed fuel injection with Continental injectors, Motec M800 ECU controlled

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE chain

DIFFERENTIAL Drechsler clutch pack limited slip, 46 Nm preload

COOLING side pod mounted radiator with thermostatic controlled electric fan

BRAKE SYSTEM 4- Disk system, floating, steel, hub mounted rotors, four piston fixed mounted callipers

ELECTRONICS Custom built Driver Interface, Fuse Box. CAN to WLAN with custom build software.

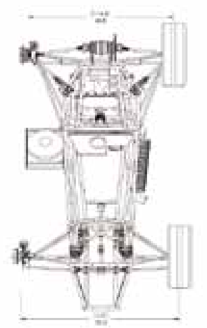
AKRON

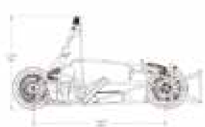
University of Akron

Car 73 Pit 37

United States

The University of Akron's 2011 Zips Racing vehicle, the ZR 11, was designed and built with three simple concepts in mind… consistency, reliability, and driveability. Using exotic materials and ingenuity the Zips Racing team managed to build and extremely light weight and maintainable race car. Some of the ZR 11's highlights include a mandrel bent titanium exhaust system, student designed one piece magnesium wheels, cockpit adjustable roll control, electronically controlled gear shifting and a one piece SLA polycarbonate intake manifold. The overall project focused on an early completion thanks to a highly skilled and dedicated team. The ZR 11 will prove to be the fastest and most competitive car that the Zips Racing Team has ever built. Zips Racing would like to thank all of our sponsors and supporters because they couldn't have done it without you!





FRAME CONSTRUCTION TIG welded Aluminum space frame with tubular steel roll bars

MATERIAL AL7020 33x3mm tubes

OVERALL L / W / H (mm) 2750 / 1430 / 1145

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 141 / 151

SUSPENSION Double unequal length A-Arm. Push rod actuated vertically oriented spring and damper

TYRES (Fr / Rr) 205 x 45 R13 Continental R25A

WHEELS (Fr / Rr) 8 x 13, 28 mm offset, 3 pc Al Rim

ENGINE Honda CBR600RR

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.0:1

FUEL SYSTEM Student des/built fuel injection, sequential

FUEL E85 ethanol

MAX POWER DESIGN (rpm) 9000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE 525 DID chain

DIFFERENTIAL Drexler Limited Slip Differential

COOLING Single radiator, mounted on top of the oil-tank, thermostatic controlled electric fans

BRAKE SYSTEM Hub mounted, 248 mm outer diameter, 146 mm inner diameter, dual piston calipers

ELECTRONICS RS485 bus connection between ECUs, multi-functional steering wheel

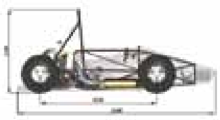
AMBERG

University of Applied Sciences Amberg-Weiden

Car 26 Pit 43

Germany

The Running Snail Racing Team has participated in several Formula Student events for 7 years. The racing car RS11 continues the concept of a Formula Student car by convincing through best dynamic ability as well as a high level of manufacturing quality. Since the team was established in 2004, it has been attending the Formula Student events in England, Germany, Italy and Hungary. For the first time, the team has challenged the FSAE competition in Michigan this year with great success by winning the "Engineering Excellence Award" and presenting the most economical car at this event. The greatest achievements in history are the winning of the „Lightweight Concept Award", the „Most Innovative Powertrain Award" and becoming the overall champion in FS Hungary 2010. According to these results the main goal for the season 2011 is to keep up the car and team performance at this high level.



FRAME CONSTRUCTION tubular space frame

MATERIAL steel (H 1.0576 (S355J2H))

OVERALL L / W / H (mm) 2649 / 1413 / 1135

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1590 / 1200 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 108 / 123

SUSPENSION Double unequal length A-Arm. Pull rod actuated horizontally orientated Oehlins spring/damper units

TYRES (Fr / Rr) 20.5x7-13 R25B Hoosier (front and rear)

WHEELS (Fr / Rr) 13

ENGINE 2010 KTM LC4 690

BORE / STROKE / CYLINDERS / DISPLACEMENT 102mm / 74.6mm / 1 cylinders / 610cc

COMPRESSION RATIO 14:1

FUEL SYSTEM Student designed / built fuel injection system using Bosch MS4 ECU

FUEL 100 octane petrol (Shell Optimax)

MAX POWER DESIGN (rpm) 9000

MAX TORQUE DESIGN (rpm) 5000

DRIVE TYPE DID 520ERT2 double o-sealing-ring chain

DIFFERENTIAL Drexler limited slip, lock-up value: 51% , 60%, 88% (drive), 29%, 60, 51% (break)

COOLING Single side pod mounted radiator with controlled electric waterpump and fan

BRAKE SYSTEM 4-Disk system, self developed rotors with 220 mm diameter, adjustable brake balance

ELECTRONICS car control unit, multifunctional steering wheel, electric shifting system, cad-des. wiring harness

ANN ARBOR

University of Michigan - Ann Arbor

Car 2 Pit 30

United States

This is the 25th year of MRacing and we have our goal set on nothing less than placing at the top at FSG2011! MRacing builds a four cylinder, steel space frame car that emphasizes light weight, high power, and reliability. With the new addition young American all star driver Rohn Sulligan, our team is sure to be one of the fastest cars on the course as we continue our rich 25 year history of winning. GO BLUE!

FRAME CONSTRUCTION 4130 Steel Spaceframe with Carbon Sandwhich Panels

MATERIAL 4130 Steel / Carbon Reinforced Sandwhich Panels with Nomex Core

OVERALL L / W / H (mm) 2590 / 1422 / 965

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1575 / 1219 / 1194

WEIGHT WITH 68kg DRIVER (Fr / Rr) 108 / 143

SUSPENSION Double unequal A-Arm with Pull Rod (F) and Push Rod (R) actuated spring. Adj. Arbs in F and R

TYRES (Fr / Rr) 10" Hoosier LC0

WHEELS (Fr / Rr) Single piece 10" forged Aluminum

ENGINE 2009 Honda CBR600RR PC40

BORE / STROKE / CYLINDERS / DISPLACEMENT 42.5mm / 67mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.5

FUEL SYSTEM Bosch MS4.4 sequential fuel injection with closed loop control

FUEL 95 Octane

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE 520 Chain drive

DIFFERENTIAL Salisbury LSd

COOLING Side mounted radiator and fan

BRAKE SYSTEM 4 disk, student designed radially mounted calipers in front, 245 mm diameter dual piston rear

ELECTRONICS 12 setting traction control, no lift shift, wireless telemetry

BARCELONA

PT University of Catalonia - Engineering School of Barcelona

Car 54 Pit 20

Spain

ETSEIB Motorsport, founded in 2007, is the Formula Student Team of the Engineering School of Barcelona. We have taken part in 7 events so far, improving our results every year. 25 students were involved in the development of this year's prototype, the CAT04.This season's main targets were to increase reliability and to improve the performance of the car. Even though we focused on the systems that caused problems during last year's competitions, all other parts of the car have been redesigned and optimized as well. We worked really hard this season, in order to have enough testing time in June to make sure it is fully operative during the competition. This has resulted in a better outcome and an overall weight reduction of more than 20 kg. This gives us even more credit considering that we have manufactured more parts than ever, including frame and several carbon fiber parts. Finally, we would like to thank all our sponsors who make our project become a reality year after year.

FRAME CONSTRUCTION Front and rear tubular space frame designed and welded by the team

MATERIAL ST-52 steel round tubing 16mm to 25mm diameter

OVERALL L / W / H (mm) 2840 / 1400 / 1080

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1100

WEIGHT WITH 68kg DRIVER (Fr / Rr) 142 / 155

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and dambper. Adjustable.

TYRES (Fr / Rr) 205x55 R13, Pirelli/205x55 R13, Pirelli

WHEELS (Fr / Rr) 7x13, -22mm offset, 1pc Al Rim/7x13, -22mm offset, 1pc Al Rim

ENGINE 2009 Honda CBR 600 RR (modified)

BORE / STROKE / CYLINDERS / DISPLACEMENT 58mm / 57mm / 4 cylinders / 602cc

COMPRESSION RATIO 13,5:1

FUEL SYSTEM Student des/built ,fuel injection, sequential, 4/8 injectors optional

FUEL Student built ,fuel injection, sequential, 4/8

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain, #520

DIFFERENTIAL Clutch pack limited slip

COOLING Left side pod mounted radiator, ECU controlled electric fan

BRAKE SYSTEM 4 floating disk system, hub mounted, adjustable brake balance

ELECTRONICS Touch Screen, student designed ECUs (shifter, cooler, dash, touch screen, traction control)

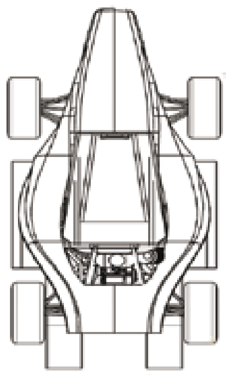
BATH

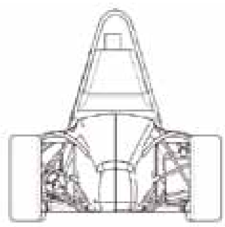
University of Bath

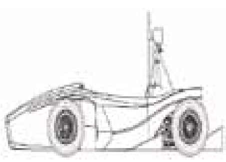
Car 33 Pit 60

United Kingdom

Relentless Team Bath Racing 2011 (RTBR11) is a team of 26 mechanical, automotive and electrical engineers from over 10 countries studying at the University of Bath in the UK.The team and RTBR11 started life in March 2010 and led to a Class 2 entry in FS-UK in July 2010, winning the design prize and finishing as overall runner up. The concept has been developed further in preparation for Class 1 entries in multiple competitions in 2011. RTBR look forward to presenting an all new concept focused on weight reduction and improved drivability. With a move away from 4 cylinder engines, the car is powered by a new Aprilia V-twin engine, saving 30kg compared to its predecessors, and helping achieve a 160kg car. Extensive engine simulation and dyno testing has resulted in increased torque at lower engine speeds and a flatter overall torque curve. This, coupled with a reduced wheelbase and narrower track, aims to provide improved transient response and drivability.







FRAME CONSTRUCTION Tubular space frame with penetration resistant composite skin between roll hoops

MATERIAL 4130 steel round tubing .5" to 1" dia / ACG MTM249 Pre-preg Carbon Fibre, with NL10

OVERALL L / W / H (mm) 2515 / 1422 / 1125

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1535 / 1170 / 1120

WEIGHT WITH 68kg DRIVER (Fr / Rr) 114 / 114

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented Ohlins spring and damper units

TYRES (Fr / Rr) 18x6 - 10" Hoosier LC0 / 18x6 - 10" Hoosier LC0

WHEELS (Fr / Rr) 6" wide, 3 pc wheel, Carbon Rim, Alu Centre / 6" wide, 3 pc wheel, Carbon Rim, Alu Centre

ENGINE Aprilia 550 RXV, 2 cylinder, V-twin

BORE / STROKE / CYLINDERS / DISPLACEMENT 85mmmm / 55mmmm / 2 cylinders / 550cc

COMPRESSION RATIO 12:1

FUEL SYSTEM Aprilia fuel pump and injectors

FUEL 98 RON Unleaded

MAX POWER DESIGN (rpm) 9000

MAX TORQUE DESIGN (rpm) 7000

DRIVE TYPE Single 420 Chain

DIFFERENTIAL Drexler FSAE Limited Slip Differential

COOLING Single side pod mounted radiator with driver controlled electric fan

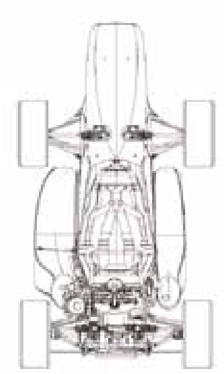
BRAKE SYSTEM Floating, Stainless Steel, hub mounted, 180mm dia. / Inboard, Floating, Stainless Steel 160 mm dia

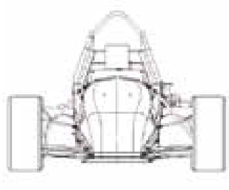
ELECTRONICS Pectel ECU, dash mounted Pi Omega D2 Display, engine start button, launch control, brake adjust

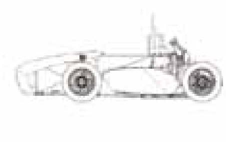
BERLIN
Technical University of Berlin

Car 80 Pit 5 Germany

2011 is the sixth season of the Formula Student Team of the Technical University of Berlin. Since our first year in this design competition, we are participating in the Formula Student Germany. Ever since we started developing a student-built racing car, our team gained a lot of experience throughout the seasons. Six years of passion, commitment, fun, effort and night shifts. Everything we learned in the past results in the FT2011. Our aim was to improve our last year's transparent bodywork which provides the look into the car's technology and combine it with an efficient drive concept in 2011. We are proud of being a part of the event at the Hockenheimring again and looking forward to see many exciting racing cars, ambitious teams and fast laps on the track!







FRAME CONSTRUCTION Tubular space frame

MATERIAL 25CrMo4 steel round tubing

OVERALL L / W / H (mm) 2705 / 1540 / 1125

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1575 / 1300 / 1280

WEIGHT WITH 68kg DRIVER (Fr / Rr) 156 / 159

SUSPENSION Double unequal length carbon tube A-Arm. Pushrod actuated 4-way-adjustable dampers on front & rear.

TYRES (Fr / Rr) Hoosier R25B 20.0x7.5-13

WHEELS (Fr / Rr) 7.0x13 OZ Racing Aluminium Rims

ENGINE 2003 Suzuki GSX-R 600

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.2:1

FUEL SYSTEM ECU with sequential injection and ignition. Adhesive bonded fuel tank.

FUEL RON98

MAX POWER DESIGN (rpm) 11500

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE Chain drive, flank pitch: 520

DIFFERENTIAL Drexler differential, limited slip.

COOLING One side pod mounted radiator with water temperature controlled electric fan.

BRAKE SYSTEM Floating discs, 230mm (front) & 212mm (rear) diameter, 4 callipers, adjustable brake balance.

ELECTRONICS Multifunctional steering wheel, electropneumatic shifting system, self developed sensor CAN unit.

BERLIN
University of Applied Sciences Berlin

Car 75 Pit 21 Germany

HTW Motorsport is entering the Formula Student Germany event for the fifth time. In 2007 the team reached a very satisfying 19th place. In this season the BRC11 (Berlin Race Car) made a tremendous evolution compared to it's older brother. The main aspect is the weight reduction of the brake system which is about 200 percent, using mountainbike brake calipers. The heart of the car is a highly modified Yamaha YZF-R6 4 cylinder engine. Also every part of the car was optimized concerning functionality and weight. The BRC11 will be a highly competitive race car specially designed for the Formula Student disciplines. The team is made up of members with different academic backgrounds. There are automotive-, mechanical and industrial engineers as well as computer scientists and business students."Make it simple!", is our mission statement.

FRAME CONSTRUCTION Walded steel tube space frame

MATERIAL Mildsteel tube EN 10025-2 (S235 JRG2)

OVERALL L / W / H (mm) 2678 / 1364 / 1259

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1590 / 1200 / 1190

WEIGHT WITH 68kg DRIVER (Fr / Rr) 140 / 200

SUSPENSION Unequal length, non-parallel double wishbone system, pushrod actuated FOX spring/dampers units

TYRES (Fr / Rr) Hoosier ; front: 205x55 R15, R25A ; rear:235x50 R13, R25A

WHEELS (Fr / Rr) Braid ; front: 13"x6" -13mm offset ; rear: 13"x7" -18mm offset

ENGINE Yamaha R6

BORE / STROKE / CYLINDERS / DISPLACEMENT 65,5mm / 44,5mm / 4 cylinders / 600cc

COMPRESSION RATIO 12,4:1

FUEL SYSTEM AME fuel injection, sequential, Yamaha Injectors

FUEL 98 octane

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE R6 gearbox, electronic shift,chain drive

DIFFERENTIAL Formula Student Drexler slip limited differential

COOLING twin side mounted radiators, operated by thermostat, electronic pumps and fans

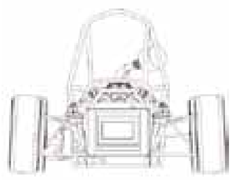
BRAKE SYSTEM 4-discs, balance bar, front: Brembo, piston: 30mm, disc: 220mm;rear: Hope, piston: 25mm, disc: 150mm

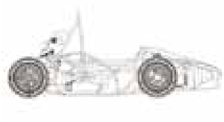
ELECTRONICS Mycron Data logger, ECU from AME, a lithium-ion battery, electric operated waterpumps and fans

BIRMINGHAM
University of Birmingham

Car 25 Pit 38

United Kingdom





2011 sees the 14th year of competition for UBRacing. This year sees the team aiming to improve its overall result at Formula Student Germany compared to the previous two competitions with the focus on development from UBR13 onto UBR14. Detailed development has continued on areas of the vehicle such as engine development, driver interaction and the optimisation of the vehicle's custom designed active differential which was introduced in 2010. UBRacing has received rewarding support from a vast array sponsors. Yamazaki Mazak UK have worked to strengthen the designs of the vehicle's uprights and differential. The team's approach to the static events and project management has been improved through the continuing relationship with Perkins Engines. McLaren Electronic Systems have kindly continued their support with the supply of its TAG400 ECU with continued work using Matlab and Simulink software. Aston Martin have assisted in the production of the vehicle's bodywork.

FRAME CONSTRUCTION Tubular steel spaceframe

MATERIAL T45 & CDS Mild Steel

OVERALL L / W / H (mm) 2700 / 1380 / 1065

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 127 / 158

SUSPENSION Double unequal length A-Arm. Push rod actuated spring with 2 way adjustable KAZ Tech Dampers.

TYRES (Fr / Rr) 20x7.5 R13 Hoosier FSAE Tyre

WHEELS (Fr / Rr) 20x7.5 R13 Hoosier FSAE Tyre

ENGINE Modified Yamaha YZF-R6 ,03-'05

BORE / STROKE / CYLINDERS / DISPLACEMENT 66mm / 45mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.4:1

FUEL SYSTEM Bespoke sequential fuel injection, McLaren TAG400 ECU

FUEL 98 octane petrol (Shell V-Power)

MAX POWER DESIGN (rpm) 11800

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE Chain drive. Steel output sprocket.

DIFFERENTIAL Student designed active differential. ECU controlled. 14 plate clutch pack arrangement.

COOLING Left hand side mounted radiator and fan system located within carbon kevlar sidepod.

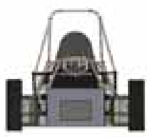
BRAKE SYSTEM 4 stainless steel floating brake discs, AP Racing Master cylinders and calipers.

ELECTRONICS MESL TAG-400 ECU, wiring harness built with Autosport connectors and Raychem wire.

BOCHUM
Ruhr University Bochum

Car 51 Pit 57

Germany



Our team, RUBmotorsport, consists of 14 highly motivated mechanical engineering students from Bochum who's aim is to reach the best possible position at the FSG event 2011. In acquiring new sponsors for this year, we are on our way to reach our goals and to establish our team as a part of the Formula Student community. Our aim is also to embed a durable progress for the next generations in our team.The basis of this years organisation and construction are the experiences and consequences we made last year.Our current vehicle's design focuses on a high reliability and a simple production processes.

FRAME CONSTRUCTION tubular spaceframe

MATERIAL 25CrMo4

OVERALL L / W / H (mm) 3250 / 1460 / 1245

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1800 / 1285 / 1285

WEIGHT WITH 68kg DRIVER (Fr / Rr) 175 / 195

SUSPENSION double enequal length A-Arm. Pushrod actuated horizontally oriented adjustable spring and damper.

TYRES (Fr / Rr) 170/515 R13 Hankook Ventus

WHEELS (Fr / Rr) 7x13, 20mm offset, 5 pc ATS

ENGINE Modified Suzuki GSX-R 600 K4

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,5:1

FUEL SYSTEM Student designed and built fuel injection

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE 525 chain MRG-Racing

DIFFERENTIAL Drexler Formula Student 2010 limited slip differential

COOLING leftside mounted Radiator electronic controlled fan

BRAKE SYSTEM 4-Disk system, 220mm rotors AP-Racing calipers

ELECTRONICS electrical shifting system

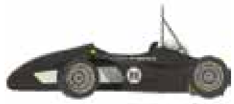
BRATISLAVA

Slovak University of Technology in Bratislava

Car 89 Pit 74

Slovakia

We will be honoured to participate at the competition in Hockenheim to compare our qualities and capabilities with the best designers of student formula racing cars. The team has been combined with a view to the future. This year we are competing with our second car in Hockenheim and we are bringing some news: new materials (aluminium alloy, carbon), a lighter and efficient engine and a new telemetric system, to keep up with our traditional strengths as are near cost, useful construction of all the parts and a trendy design of the bodywork.Thanks to the support from the faculty, university and the team's pedagogical advisors we succeeded in getting over the most difficult problem – filling up the team budget at the time of the financial crisis. Applying the advanced methods of production for all parts of the car, and also applying the advanced software systems CATIA, ANSYS and ADAMS. We hope for a successful start and a suitable weather for all the teams during the competition!



FRAME CONSTRUCTION Frot and rear tubular space frame

MATERIAL ISO 630:1980 steel round tubing 16mm to 25mm

OVERALL L / W / H (mm) 2700 / 1270 / 1120

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 150 / 188

SUSPENSION Double wishbone with pushrod

TYRES (Fr / Rr) Goodyear Eagle 20.0x7.0 R13

WHEELS (Fr / Rr) Braid 7" x 13"

ENGINE 2008 Aprilia RXV 550

BORE / STROKE / CYLINDERS / DISPLACEMENT 80.0mm / 55.0mm / 2 cylinders / 549cc

COMPRESSION RATIO 12.5:1

FUEL SYSTEM Student designed/built fuel injection system using Haltech ECU

FUEL Natural 95

MAX POWER DESIGN (rpm) 13000

MAX TORQUE DESIGN (rpm) 10900

DRIVE TYPE Chain CZ 520

DIFFERENTIAL Drexler Formula Sae Specific Differential v2

COOLING 2 mounted radiators with thermostatic controlled one electric fan

BRAKE SYSTEM Brembo, 240/230 mm diameter, drilled

ELECTRONICS Multifunctional Steering Wheel, National Instrument for telemetric system

BRAUNSCHWEIG

Technical University of Braunschweig

Car 91 Pit 70

Germany

This year the Lions Racing Team proudly presents it's ninth FSAE Competition Vehicle, the LR11. Relying on our proven and fast concept, the car features advanced vehicle dynamics with 4 way adjustable dampers and a sophisticated electronics system consisting of a race ABS, traction control, launch control and data logging. We use a powerful 4-cylinder combustion engine with a dry sump lubrication to achieve a low centre of gravity as well as good reliability. Furthermore we made a steel space frame with hollow nodes to balance low weight and good serviceability. To keep the back wheels in control, the car has a Torsen differential ensuring good traction out of a corner. Traditionally the Continental Formula Student Tire is developed in close cooperation with our team. For this year we focused on warm-up characteristics and carcass construction to make it the fastest Formula Student Tire ever. We hope to achieve a good result and are looking forward to meet you at our pit in Hockheim.

FRAME CONSTRUCTION Tubular space frame with supporting frames and hollow nodes

MATERIAL 25CrMo4 steel round tubing 10mm to 25mm dia

OVERALL L / W / H (mm) 2642 / 1318 / 1072

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1525 / 1140 / 1072

WEIGHT WITH 68kg DRIVER (Fr / Rr) 125 / 153

SUSPENSION Double unequal length A-Arm. Push rod actuated CaneCreek spring/damper units , Anti-roll bar (Rear)

TYRES (Fr / Rr) 205x510 R13 / 205x510 R13, Continental 2011

WHEELS (Fr / Rr) 7x13.0mm offset 3 pc Al Rim / 7x13.0mm offset 3 pc Al Rim

ENGINE Suzuki GSXR-600 K4

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13,5:1

FUEL SYSTEM Student designed/built fuel injection system using MoTeC M800 ECU, sequential

FUEL gasoline 98 Octan

MAX POWER DESIGN (rpm) 12500

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain 520

DIFFERENTIAL Torsen University Special modified. Bias ratio 2.6:1

COOLING 2 radiators with 3 controlled electric fans, mounted in two side pods

BRAKE SYSTEM Front: 2 x Brembo P32G, 2x32 mm piston, mtg, Rear: 2 x AP Racing CP7003, 2x25,4 mm piston, mtg

ELECTRONICS traction control; launch control; automatic shifting; ABS system

CAMBRIDGE

University of Cambridge

Car 82 Pit 10

United Kingdom

The aim of Full Blue Racing this year is to produce a car thatis low cost, yet fast and reliable. The team started the design in mid-August in order to achieve early build of thecar so a sufficient amount of testing could be performed before the competitions.The team keeps its no-compromise attitude towards design despite the tight schedule set. The major innovation this year lies in the hybrid chassis design, with an aluminium structure used at the rear to replace the original space-frame design to reduce weight as well as manufacturing time.We have launched a new website and sponsorship brochure and held several publicity events to promote the team as well as the competition, which has proved to be very successful. The FBR11 would not have been posible without our sponsors and supporters who have provided vital resources,advices and encouragement – thank you to all thoseinvolved.

FRAME CONSTRUCTION Steel tubular space frame with rear Ali plate structure

MATERIAL Mild steel to BS 6323

OVERALL L / W / H (mm) 2500 / 1422 / 1150

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1250 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 150 / 168

SUSPENSION Double unequal length A-arm,front pull rod rear push rod bellcrank activated damper and spring units

TYRES (Fr / Rr) 20x13 Avon A45 tyres

WHEELS (Fr / Rr) 6.0 x 13, 12mm offset, Aluminium alloy wheels

ENGINE Yamaha 2004 FZ6

BORE / STROKE / CYLINDERS / DISPLACEMENT 65.5mm / 44.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.2:1

FUEL SYSTEM Student designed/built fuel injection system using Megasquirt2 ECU

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11200

MAX TORQUE DESIGN (rpm) 7500

DRIVE TYPE Chain drive

DIFFERENTIAL fixed spool

COOLING side mounted single radiator

BRAKE SYSTEM 3-disk system, self developed rotors with 230mm diameter, adjustable brake balance, floating disk

ELECTRONICS MOSFET circuit, electrical drive sequential shifting system, self-designed telemetry system

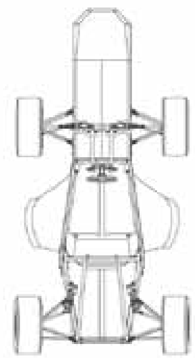
CARDIFF

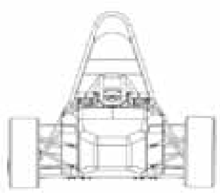
Cardiff University

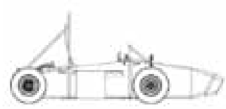
Car 31 Pit 50

United Kingdom

Cardiff Racing is a team of multi-disciplined Engineering students from first year undergraduates through to post graduates. This year's entry, CR07, has been designed mainly by fourth year design students, while the volunteers carry out manufacturing, marketing and dynamic testing.CR07 builds upon the experience gained by the team in previous years. The chassis is a complete monocoque, constructed from lightweight, high stiffness aluminium honeycomb composite panels. The sidepods house cooling and electrical systems allowing space at the rear for more efficient packaging and easier engine maintenance.Power is provided by an Aprilia SXV 550 V-Twin engine with optimised intake and exhaust systems. The engine uses a custom ignition and fuel map developed in-house using the Cardiff University engine dynamometer. Power is transmitted through a student designed aluminium spool. The suspension system is the lightest yet from Cardiff Racing, utilising Fox Van RC dampers.







FRAME CONSTRUCTION Aluminium Honeycomb monocoque, Carbon Fibre sidepods, nose-cone and firewall

MATERIAL 5251, 6082 Aluminium cellite panels with erw mild steel roll hoops

OVERALL L / W / H (mm) 2635 / 1325 / 1140

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1550 / 1150 / 1100

WEIGHT WITH 68kg DRIVER (Fr / Rr) 110 / 140

SUSPENSION Double unequal length A-Arm. Push rod / Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) Hoosier C2000 R25B (18x6.0-10/18x7.5-10)

WHEELS (Fr / Rr) 3pc centre lock wheel, Al rims 6.0"/7.0" wide, 1.25"/2" negative offset, aluminium centres

ENGINE 2010 Aprilia SXV 550 V-Twin

BORE / STROKE / CYLINDERS / DISPLACEMENT 80mmmm / 55mmmm / 2 cylinders / 553cc

COMPRESSION RATIO 12.5:1

FUEL SYSTEM Student designed fuel tank and piping, Bosch injectors

FUEL 98 Octane Unleaded Petrol (Shell Optimax)

MAX POWER DESIGN (rpm) 10750

MAX TORQUE DESIGN (rpm) 7960

DRIVE TYPE Single 520 Chain

DIFFERENTIAL Student designed Aluminium Spool (Live Axle)

COOLING

BRAKE SYSTEM Front: Floating, cast iron, hub mounted. Rear: Single cast iron, Spool mount

ELECTRONICS Traction Control, Launch Control, Ignition-Cut Gear change. Data logging via NI CompactRIO

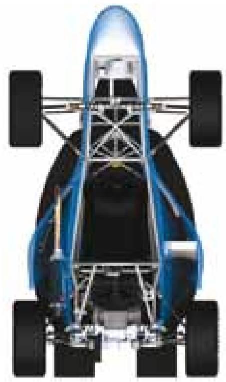
COBURG

University of Applied Sciences Coburg

Car 70 Pit 8

Germany

Founded in 2007, CAT-Racing enters FSG Combustion for the fourth time in a row. Our 35 members are looking forward to compete with teams from all over the world and present the C-11 Jaguar to the well known international judges. The growing standards and knowledge in every new season leads to deeper scientific work and more complex mechanism. So we focused on designing a racecar which is tailored on a Formula Student racetrack. An adapted gearbox in combination with a fast pneumatic shifting will also increase performance on tight and curvy courses. To meet the small size requirements, we maximized packaging via back plate, which merges all components at the rear.CAT-Racing thanks all sponsors, friends and families who made this project possible. We hope to meet and even exceed everyone's expectations. For more information, please visit our website. (www.cat-racing.net)



FRAME CONSTRUCTION Front and rear tubular spaced steel frame

MATERIAL S355 JR / S235

OVERALL L / W / H (mm) 2545 / 1476 / 1116

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1570 / 1230 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 135 / 153

SUSPENSION Double unequal anti-parallel A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 20,5x7 R13 R25B / WET (Hoosier)

WHEELS (Fr / Rr) Keizer 7x13, 5mm offset, Al/Mag Rim

ENGINE Modified Yamaha R6 / RJ05

BORE / STROKE / CYLINDERS / DISPLACEMENT 65.5mm / 44.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 15.5 :

FUEL SYSTEM student designed / built; fuel injection Bosch ECU

FUEL RON 98

MAX POWER DESIGN (rpm) 11500

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE Roller - Chain 520

DIFFERENTIAL - Limited Slip Differential preload 30Nm - TBR=2,33 (factory set)

COOLING single radiator (600cc) in right sidepod and 231mm electric fan

BRAKE SYSTEM 4-Disc system, rotors with 218mm outer diam, adj. brake balance, Quadruple piston front, Dual rear

ELECTRONICS Real Time Operating System (FreeRTOS), Fuel Pump with level indicator, brake balance adj. by driver

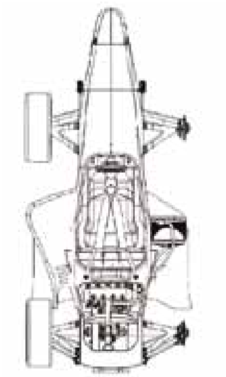
DARMSTADT

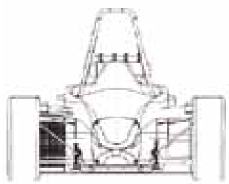
Technical University of Darmstadt

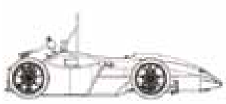
Car 4 Pit 13

Germany

DART Racing participates in the Formula Student Germany since 2006. Over 35 highly motivated students from various branches of study are working on this year's car, the zeta2011. Thorough analysis of the existing concepts lead to targeted designs which consider especially weight reduction and improvement of drivability. As in the years before DART Racing stands for innovative and progressive engineering design: The use of E 85 containing bioethanol for example does not only improve the fuel consumption but shows furthermore our dedication to sustainability and reduces our carbon footprint.DART Racing is looking forward to an interesting and hopefully sucessful Formula Student Germany competition. We would like to thank all sponsors and supporters who make the participation in Formula Student events even possible.







FRAME CONSTRUCTION CFRP Monocque sandwich construction

MATERIAL Carbon fibre/epoxy composite, aluminum honeycomb, Rohacell

OVERALL L / W / H (mm) 2815 / 1415 / 1110

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1220 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 130 / 148

SUSPENSION Double unequal length A-Arm. Pull rod actuated horizontally oriented spring and damper.

TYRES (Fr / Rr) 185/40 R15 Pirelli

WHEELS (Fr / Rr) 7 inch wide Al-Rim 10mm neg. offset

ENGINE Suzuki GSX-R 600 K2

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 14,8:1

FUEL SYSTEM Student des/built, sequential, cylinder selective dual stage injection, MoTeC M800

FUEL E85

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 9200

DRIVE TYPE Chain

DIFFERENTIAL Drexler, limited slip

COOLING Side pod mounted radiator with ECU controlled fan and waterpump

BRAKE SYSTEM Self designed 200mm OD rotors, hub mounted

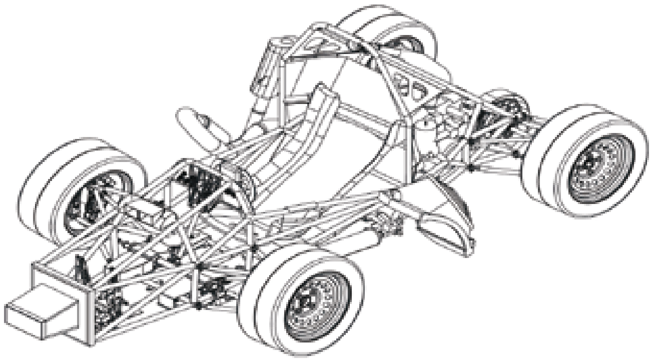
ELECTRONICS Multifunctional steering wheel, Electropneumatic shifting system, Self designed Telemetry System

DEGGENDORF

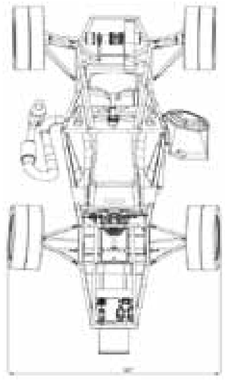
University of Applied Sciences Deggendorf

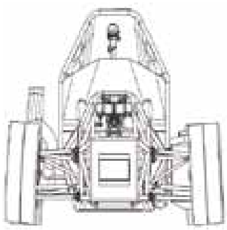
Car 78 Pit 23

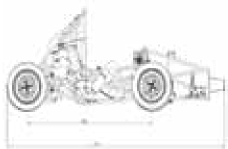
Germany



Fast forest represents the UAS Deggendorf in formula student events. Founded in june 2008 our third season team consists of 30 active team members from every faculty of our university. Being in the third season the team put much effort into improving the dynamic characteristics of the second year car, the FF02 without accepting compromise in terms of reliability. Besides optimized power weight ratio we tried to the serve the driver with the most comfortable cockpit design possible: completely electronic operated gear shifting system, a lot of ellbow room and low steering forces. The car is developed to be driven by either gas or electrical power without having to make changes to the frame, the suspension or the cockpit. You'll find further information on www.fastforest.de !







FRAME CONSTRUCTION Turbular space frame with carbon floor plate

MATERIAL 1020 and 4130 steel round tubing 5mm to 25mm dia

OVERALL L / W / H (mm) 2896 / 1358 / 1090

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1610 / 1236 / 1215

WEIGHT WITH 68kg DRIVER (Fr / Rr) 143 / 174

SUSPENSION Double unequal length A-Arm. Pull rod actuated horizontally/vertical oriented spring and damper

TYRES (Fr / Rr) 205/510 R 13 34M Continental

WHEELS (Fr / Rr) Braid Formrace 16, 13x7J ET 18 one pice, alloy

ENGINE 2008 Yamaha YZF R6 RJ15 4 cylinder 599ccm

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.1:1

FUEL SYSTEM Continental Injectors/Rail, sequential

FUEL fuel, 100 Ron

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE chain

DIFFERENTIAL Drexler limited slip

COOLING side pod mounted radiator with thermostatic controlled electric fan

BRAKE SYSTEM Magura cylinders, student designed disks, floating, hub mounted, 240mm diameter

ELECTRONICS free programmable BOSCH ECU, CAN-BUS system and self-developped steering wheel display, datalogging

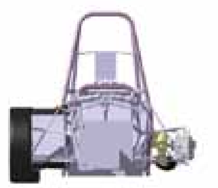
DORTMUND

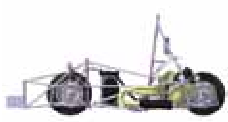
Technical University of Dortmund

Car 48 Pit 46

Germany

GET racing is the Formula Student team of Dortmund University of Technology (TU Dortmund). It was founded in 2005, competing with the first car in 2006. Since then, a constant development has happened, leading to some notable achievements: In 2007, the GT07 was the first car to feature an airbox made by rapid prototyping. The FS29 was our first car with an optimized spaceframe, using our own evolutionary algorithm.The current car, the FS210B, features some thorough engineering: The frame has been optimized evolutionarily. The suspension was designed to meet the tyre characteristics precisely. It features double unequal-lenght A-Arms all around and custom built Bilstein Dampers. The engine has modified camshafts, a modified shifting scheme, a slipper clutch for clutchless downshift and a self-designed drysump conversion. Gearbox controller, multifunctional cockpit and datalogger are self-designed and communicate via CAN, allowing clutchless upshift. Live telemetry via WLAN is possible.





FRAME CONSTRUCTION Tubular steel space frame. Design optimized with a self-designed evolutionary algorithm.

MATERIAL 25CrMo4, tube diameters from 6mm to 30mm.

OVERALL L / W / H (mm) 2840 / 1365 / 1198

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1208 / 1130

WEIGHT WITH 68kg DRIVER (Fr / Rr) 125 / 188

SUSPENSION Doubele unequal length A-Arms in front and rear. Pushrod actuated, fully adj custom bilstein dampers

TYRES (Fr / Rr) 20.5x6.5-13 R25B Hoosier / 20x7.5-13 R25B Hoosier

WHEELS (Fr / Rr) 6.0x13, 10.8mm offset, 3pc Al-Mg BBS rim / 8.0x13, 2,6mm offset, 3pc Al-Mg BBS rim

ENGINE YAMAHA R6 (RJ05), drysump, cams and gearbox mod.

BORE / STROKE / CYLINDERS / DISPLACEMENT 65.5mm / 44.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.4:1

FUEL SYSTEM DTAfast ECU, fully sequential injection and firing. Ignition cut on upshifts and overrun fuel cutoff

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE 520 roller chain

DIFFERENTIAL DREXLER limited slip clutchpack diff. Interneal preload adjustment. 35Nm preload

COOLING 900cc Seat Ibiza cooler in right sidepod. Electronically controlled electric fan.

BRAKE SYSTEM 4-Disk system. Student des. rotors and Spiegler calipers. Adj. brake balance

ELECTRONICS Electropneumatic shifting unit, selfdesigned gearbox control unit, multifunctional cockpit

DORTMUND
University of Applied Sciences
Dortmund

Car 36 Pit 22 Germany

The Race-Ing. Team of the University of applied Sciences and Arts Dortmund participates at Formula Student Events for four years. Since the foundation the team structure as well as the infrastructure could be expanded and optimized. With an average number of team members of about 15 over the years the Race-Ing.Team is working in two year development periods.This means a fully new developed race car every two years with a forceful optimized second year version in between.For this FS-season the RI-ölf is a new development of about 20 committed students.Like every vehicle made by Race-Ing. the RI-ölf has a carbon fiber monocoque. New this year is a divisible rear for better maintenance.The aim for the RI-ölf is a consistent weight reduction while not losing durability to provide high racing performance.Furthermore it is the Team's intent to belong to the 20 best german Formula Student Teams. The Race-Ing. Team wishes you an amazing event and good luck for the competition to all teams!

FRAME CONSTRUCTION Carbon fibre monocoque with honeycomb core, divisible rear for easier maintenance

MATERIAL carbon fibre prepreg 400g/mm² respectively 200g/mm², nomex honeycomb core

OVERALL L / W / H (mm) 2720 / 1348 / 987

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1640 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 148 / 181

SUSPENSION Double unequal length A-Arm. Pull rod (front)/ Push rod (rear) actuated vertically oriented damper

TYRES (Fr / Rr) 20.5 x 7.0-13, Hoosier R25B / 20.5 x 7.0-13, Hoosier R25B

WHEELS (Fr / Rr) 6.5 x 13, 0mm offset, 3pc Al Rim with Mg cen/ 6.5 x 13, 0mm offset, 3pc AL Rim with Mg cen

ENGINE Modified HONDA CBR600F (PC35)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.0:1

FUEL SYSTEM trijekt ECU, student designee, sequential injection & ignition timeing

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12500

MAX TORQUE DESIGN (rpm) 9800

DRIVE TYPE Chain drive

DIFFERENTIAL Drexxler limited slip differential, max torque: 1200Nm, preload: 10Nm

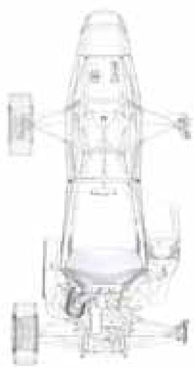
COOLING Side pod mounted radiator with electric controlled SPAL fans

BRAKE SYSTEM 4-Disc-system, 240mm diameter, driver adjustable bias bar, two 34mm opposing pistons/calipe

ELECTRONICS selfdesigned datalogger, bidirectional WLAN streaming, multifunctional display, el. shifting System

ERLANGEN
University of Erlangen-Nuremberg

Car 74 Pit 35 Germany



High-Octane Motorsports is the University of Erlangen-Nuremberg's FS team. This year our 45 team members developed our fourth race car, the FAUmax delta. Our main goals were to significantly reduce weight and to switch to 10 inch wheels, by also refining our stand-alone drivetrain layout with a longitudinally mounted engine and a bevel gear. As a result we developed a lightweight car of 160 kg in combination with a powerful Aprilia V2 engine with 58 kW, that combines both the advantages of a powerful 4-cylinder car and a lightweight 1-cylinder car. To drastically reduce unsprung masses we developed 10 inch rims, which are made out of aluminium and CFRP. Our steel tube frame has an integrated CFRP sandwich structure as an underbody, combining high stiffness and low weight. The reliability of our electronics were enhanced by replacing all fuses with high side switches. With our promising car we are looking forward to the competitions and want to thank all our sponsors for their support!

FRAME CONSTRUCTION Steel tubular space frame with detachable rear frame, carbon fibre underfloor

MATERIAL S355

OVERALL L / W / H (mm) 2601 / 1385 / 1027

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1530 / 1220 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 107 / 121

SUSPENSION unequal length A-arms....

TYRES (Fr / Rr) 18x6 R10 Hoosier LCO

WHEELS (Fr / Rr) Custom made 10"x6,5", 35mm offset, CFRP/Aluminium

ENGINE Modified Aprilia SXV 550

BORE / STROKE / CYLINDERS / DISPLACEMENT 80mm / 55mm / 2 cylinders / 553cc

COMPRESSION RATIO 15,6:1

FUEL SYSTEM student designed/built fuel injection system using DTAfast S80 Pro ECU

FUEL E85

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 7500

DRIVE TYPE bevel drive with claw coupling

DIFFERENTIAL Drexler limited slip differential

COOLING Reverse flow cooling system with Aluminium counter-stream radiator,ECU controlled fan&pump

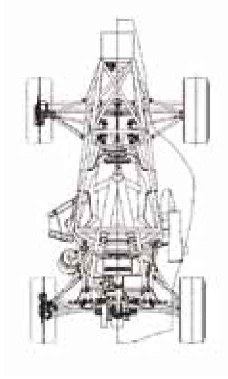
BRAKE SYSTEM 4-Disk system, self developed steel rotors with 200 (f)/170 (r) mm diam., adjustable brake balance

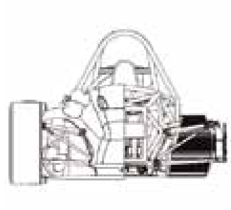
ELECTRONICS selfdesigned MCU w. High-Side-Switches, Bluetooth live-telemetry, high-speed shifting servo

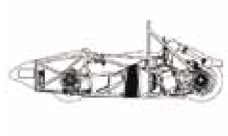
ESSLINGEN
University of Applied Sciences Esslingen

Car 94 Pit 1 Germany

In 2006 the first building blocks for the foundation of the Rennstall Esslingen were placed at the University of Applied Sciences Esslingen. Meanwhile, it is the largest project at the university and one of the flagship projects. The Stallardo ,11 is the fifth race car from Esslingen to compete at the Formula Student Germany as well as at the events in Austria and Italy. The knowledge and experience of the previous years are reflected in this year's car. The Team's goal was to build a lightweight, reliable, powerful and fast car. We kept the basic concept with a transversely mounted 4 cylinder engine and a tubular steel space frame from last year's car. However, each individual component has been revised and optimized. The engine tuning includes a new camshaft, new pistons and many other modifications. A custom designed gearbox, steering rack and cooling system are a few major design highlights. For more information visit our Homepage: http://www.rennstall-esslingen.de.







FRAME CONSTRUCTION Tubular Space Frame

MATERIAL 25CrMo4 (4130) steel round tubing 19,05mm up to 31,75mm diameter, Carbon Fibre Floorpan

OVERALL L / W / H (mm) 2571 / 1440 / 968

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1580 / 1240 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 123 / 134

SUSPENSION Double unequal length A-Arm. Pull rod actuated front dampers, Pull rod actuated rear dampers,

TYRES (Fr / Rr) 20.5 x 7.0 - 13, Hoosier R25B

WHEELS (Fr / Rr) 20.5 x 7.0 - 13, Hoosier R25B

ENGINE Modified Honda CBR600RR (PC37)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.5mm / 42.5mm / 4 cylinders / 609cc

COMPRESSION RATIO 13,7:1

FUEL SYSTEM Bosch MS4, fuel injection, SF Motorsporttechnik Fuel pump

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 9000

DRIVE TYPE 520 Chain

DIFFERENTIAL Salisbury type clutch pack differential from Drexler

COOLING Student designed u-flow radiator, left side, electric fan

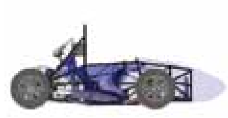
BRAKE SYSTEM 4-Disk self developed rotors, Front: 4-piston ISR Caliper, Rear: 2-piston ISR Caliper

ELECTRONICS Bosch MS4 ECU, Electro mechanical shifting system, Souriau Motorsport connectors

FREIBERG
Technical University of Freiberg

Car 76 Pit 29 Germany

The Racetech Racing Team proudly presents its new racing car RTo5. After four increasingly succeeding racecars since 2005, great expectations laid on the new very young team of the race smithy from Freiberg. The season began with 38 students and promising ambitions. We modified the camshaft and developed a new gearbox that perfectly matches the requirements of Formula Student competitions. Furthermore we are racing with one of the lightest carbon fibre rims of the FS worldwide. Another great development was the simulation of the wiring harness in a 3D CAD system allowing the manufacturing of the harness independently to the racecar. Our drive train is based on self designed tripod joint shafts joined and hardened by an electron beam technology. Completed by our unique silvery shining body shell made of magnesium sheets we are entering the competition with a weight reduction of almost 20 kg. Our team is looking forward to compete at this year's FS Germany with the new racecar RTo5.



FRAME CONSTRUCTION tubular space frame

MATERIAL 4130 steel round tubing 12 mm to 25 mm dia

OVERALL L / W / H (mm) 2700 / 1447 / 1067

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1560 / 1240 / 1220

WEIGHT WITH 68kg DRIVER (Fr / Rr) 132 / 143

SUSPENSION double unequal length A-Arm. Pull rod actuated horizontally & longitudinally oriented spring &damper

TYRES (Fr / Rr) 205x7.0-13, Hoosier R25B / 205x7.0-13, Hoosier R25B

WHEELS (Fr / Rr) 7x13, 34 mm offset, carbon rim / 7x13, 34 mm offset, carbon rim

ENGINE 2005 Honda CBR 600 RP (PC37)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,9:1

FUEL SYSTEM student built fuel tank, sequential fuel injection, twin spray injection valves

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 9000

DRIVE TYPE chaindrive with 520-chain

DIFFERENTIAL limited slip differential from Drexler, 25 Nm preload, bias ratio 3:1

COOLING divided oil and water cooling system, position in side pods, thermal control

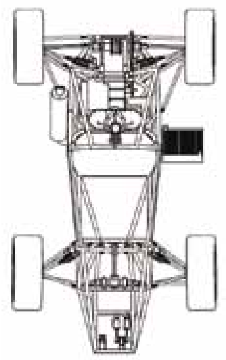
BRAKE SYSTEM 4-disk system, self developed rotors with 203 mm diameter, adjustable break balance, ISR calipers

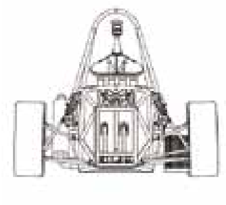
ELECTRONICS launch control, map switch, traction control, pedal or automatic shifting, W-LAN telemetry system

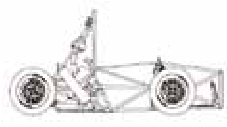
GLASGOW
University of Strathclyde

Car 15 Pit 28

United Kingdom







University of Strathclyde Motorsport are returning to the Hockenheimring for the fourth time with USM11, the team's eleventh Formula Student car and the most exciting yet. Building on the success and reliability of its predecessors, USM11 features a number of significant developments. New swept-back rear wishbones have resulted in a lighter chassis, and an engine upgrade from the previous Honda CBR600F4i to the CBR600RR8 has reduced mass, improved packaging and increased performance. Student-designed hubs, uprights, pedals and differential mounts have all provided weight reductions, and the new custom dry sump system lowers the centre of gravity. USM has undergone a significant team restructure this year, with engineering students working alongside their business counterparts to understand how best to market and promote the car and team to sponsors and judges alike. We'd like to say thanks to all our sponsors, and best of luck to all at FSG2011!

FRAME CONSTRUCTION Tig welded steel spaceframe

MATERIAL Mild steel

OVERALL L / W / H (mm) 2533 / 1386 / 1136

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1535 / 1200 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 142 / 140

SUSPENSION Unequal length A-Arms. Push rod actuated Cane Creek/Ohlins Double Barrel spring/damper units

TYRES (Fr / Rr) Goodyear Eagle 508 x 177-330 D2696

WHEELS (Fr / Rr) OZ Superleggera 13"x7", 25mm offset

ENGINE Honda CBR600RR8

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.2:1

FUEL SYSTEM DTA S60 PRO ECU with sequential fuel injection system

FUEL 98 octane unleaded petrol

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain #525

DIFFERENTIAL Drexler clutch pack limited-slip differential

COOLING Side-mounted custom radiator and fan

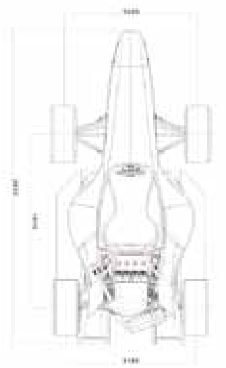
BRAKE SYSTEM Wilwood GP320 (front) and PS1 (rear) calipers with twin AP Racing master cylinders and balance bar

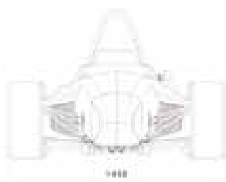
ELECTRONICS Custom dash and steering wheel with electro-pneumatic gearshift system and launch control

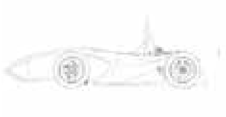
GRAZ
Technical University of Graz

Car 63 Pit 54

Austria







Regarding the potential of our last year's car, we decided to make the Tankia 2011 an evolution of its precursor. Behind his aggressive but also elegant appearance the Tankia 2011 is hiding a lot of highly sophisticated technical solutions. With a weight of less than 190 kg and an engine which produces 76 hp it has an outstanding power to weight ratio. It comes up with a carbon fiber monocoque and a completely new designed carbon fiber space frame rear end, which is stiffer and makes it possible to remove the engine very quickly. Other highlights of the Tankia 2011 are the one-piece carbon fiber rims, hollow titanium uprights made by EBM technology, variable intake tube lengths, self-developed multifunctional steering wheel, which gives the driver the chance to adjust brake balance and other things during driving. Our Team consists of 39 ambitious members and is divided into four technical (chassis, electronics, powertrain, suspension) and two non-technical departments.

FRAME CONSTRUCTION carbon fiber monocoque and carbon fiber spaceframe rear-end

MATERIAL carbon fiber prepregs, Nomex and Aluminium honeycombs, carbon-inserts

OVERALL L / W / H (mm) 2852 / 1453 / 993

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1575 / 1220 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 124 / 129

SUSPENSION unequal length a-arms, front pull/rear push rod and bell crank actuated 3-way adjustable dampers

TYRES (Fr / Rr) 20x7,5-13 Hoosier R25B

WHEELS (Fr / Rr) 7.0x13, self made one piece carbonfiber Rim

ENGINE 2006 Yamaha R6

BORE / STROKE / CYLINDERS / DISPLACEMENT 67,0mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13,7:1

FUEL SYSTEM student designed and built ,fuel injection, 2-spray preparation

FUEL 100 octane petrol

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain #520

DIFFERENTIAL Drexler, multiplate limited slip differential

COOLING twin side pod mounted radiators with thermostatic controlled electric fans

BRAKE SYSTEM 4-disc system, self designed steel rotors, adjustable brake balance

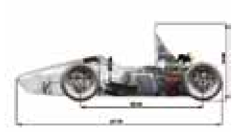
ELECTRONICS multifunctional steering wheel, traction and launch control, live-telemetry system

GRAZ
University of Applied Sciences
Joanneum Graz

Joanneum racing graz is a highly motivated team from the U.a.S „FH Joanneum" in Graz. The team competes in Formula Student since 2004 and is well known as „The Weasels". A new car has been built every year since then. The team members change every year, what brings a lot of new ideas to the team. The basic team consists of approximately 25 Vehicle Technology students supported by students from different study courses from the UAS in Graz. Therefore joanneum racing graz is a very innovative team with new features in every car. In the history of the team charged single cylinder engines have been used in each car. The new car is also powered by a turbocharged single cylinder engine. The chassis of the car is made of CFRP and represents latest technology. Last year's car showed that the combination of lightweight chassis and efficient but also powerful turbocharged engine is competitive. The team 2011 enhanced turbocharger technology and is keen on proving the competitiveness of the car.

Car 11 Pit 4

Austria



FRAME CONSTRUCTION Full CFRP monocoque, roll-over hoops integrated in front monocoque

MATERIAL Aramid honeycomb sandwich panel, alumiuim honeycomb core in the rear monocoque

OVERALL L / W / H (mm) 2770 / 1430 / 1040

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1230 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 116 / 117

SUSPENSION Double unequal length A-Arm, pull rod actuated

TYRES (Fr / Rr) 20.5 x 6.0 x 13, Hoosier R25B

WHEELS (Fr / Rr) 6 x 13 inch CFRP wheels

ENGINE BRP Rotax Type 449 single-cylinder, turbocharged

BORE / STROKE / CYLINDERS / DISPLACEMENT 97mm / 60.8mm / 1 cylinders / 449cc

COMPRESSION RATIO 13.1:1

FUEL SYSTEM Bosch Motorsport 2-point injection system

FUEL E 85

MAX POWER DESIGN (rpm) 7400

MAX TORQUE DESIGN (rpm) 5200

DRIVE TYPE Chain drive

DIFFERENTIAL Drexler limited-slip differential

COOLING side-mounted air-water cooler with electric fan, oil-water cooler in the rear monocoque

BRAKE SYSTEM 230mm / 210mm diameter disks, hub mounted, drilled, laser cut

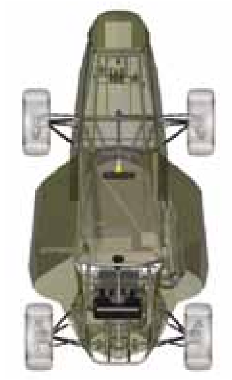
ELECTRONICS Multifunctional Steering Wheel, Electropneumatic Shifting System, Radio Communication, Data Logging

HAMBURG
Helmut Schmidt University of Federal
Armed Forces Hamburg

This year's car of the Helmut Schmidt University – University of the German Federal Armed Forces Hamburg is the R.U.S.H. 11. It is the fourth time the Eleven-O-Six Racing Team takes part in a Formula Student Event and we are proud to present the successor of the R.U.S.H. 10. This year our car design is based on a F-117 Nighthawk stealth fighter which is represented by the sharp-edged silhouette and its aggressive looks. Further improvements in engine performance and chassis kinematis as well as a new lightweight tubular space frame backup our high expectations for this year's event. Similar to its predecessor the R.U.S.H. 11 features an iPhone dashboard in order to provide any information necessea-ry for both the driver and the pit crew during the race. Altogether the R.U.S.H. 11 is another excellent example for our team once again following its motto: passion of engineering. Thanks to all of our supporters, who made this possible.

Car 72 Pit 41

Germany



FRAME CONSTRUCTION Tubular space frame

MATERIAL 235 steel round tubing. 12mm to 30mm dia

OVERALL L / W / H (mm) 2690 / 1425 / 1012

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1220 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 140 / 158

SUSPENSION Double unequal length A-Arm.Pull/Push rod actuated vertically oriented spring and damper

TYRES (Fr / Rr) 20.5x7 - R13 Hoosier R25B

WHEELS (Fr / Rr) 7.0x13,18mm offset, 2 pc Al Rim

ENGINE optimized Honda CBR600F - PC35

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.1:1

FUEL SYSTEM original Honda PC 35 sequential fuel injection

FUEL gasoline

MAX POWER DESIGN (rpm) 11500

MAX TORQUE DESIGN (rpm) 10500

DRIVE TYPE chain 520 modul

DIFFERENTIAL Drexler limited slip differential

COOLING single radiator with thermostatic controlled fan

BRAKE SYSTEM 4-Disk system, self developed rotors (218mm dia), adjustable brake balance, AP Racing brake calipers

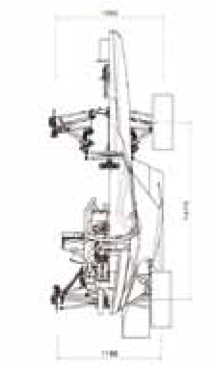
ELECTRONICS Multifunctional Steering Wheel, Electronic Shifting System, iPhone (connected via CAN to MoTec)

HAMBURG
University of Applied Sciences
Hamburg

Car 69 Pit 66

Germany

HAWKS Racing Hockenheim 2011Presenting HAWKS Racing, a formula student team from HAW Hamburg founded in 2003. 53 Students from several departments such as automotive, mechanical and electrical engineering and business studies are part of this team. Since 2010 we are a registered association and launched 2011 a modern corporate identity which is supposed to take HAWKS Racing to the next level of professionalism. Dedicated to the passion of engineering, design and business we spent most of our time developing a new car, this years H06.9.It was the next evolutionary step, to make our self-designed monocoque, rims and the exterieur completely out of carbon. Hence we are expecting high weight saving as well as an extraordinary look for our new Hawk!HAWKS Racing always represents high performance and stands for an incredible team spirit (which is the basis for leading our Hawk to great power) based on which we lead our hawk to great power.



FRAME CONSTRUCTION monocoque and rear tubular space frame

MATERIAL sandwich composite construction / S235 tubes from 30 to 20mm diameter

OVERALL L / W / H (mm) 2890 / 1420 / 998

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1670 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 129 / 140

SUSPENSION Double unequal length A-Arm. Pull rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 20x7.5-13 R25B Hoosier / 20x7.5-13 R25B Hoosier

WHEELS (Fr / Rr) 7.0 x 13, 1 piece carbon, 22mm neg. offset

ENGINE 2001 Kawasaki ZX-6

BORE / STROKE / CYLINDERS / DISPLACEMENT 66.0mm / 43.8mm / 4 cylinders / 599cc

COMPRESSION RATIO 11,8:1

FUEL SYSTEM Student des/built, fuel injection, sequential

FUEL gasoline

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE 520 chain

DIFFERENTIAL clutch pack limited slip / Drexler

COOLING one side mounted radiator with termostatic controlled electric fan

BRAKE SYSTEM Floating, hub mounted, 250mm dia. vented

ELECTRONICS Loom connecting the ECU, Dashboard, Datalogger and the self-developed Gear Control Unit

HANNOVER
University of Applied Sciences
Hannover

Car 102 Pit 16

Germany

The FHH Motorsport team is a small crew with about 25 members and was founded in 2008. As there hasn't been anything like a Formula Student team at our UAS, we have been in the honorable position to establish a solid foundation for future teams. In the season of 10/11 we built our second car. We focused on designing and building a solid car to withstand the challenges of the european formula student events while being relatively cheap & easy to maintain and repair. We produced most parts of the car on our own to improve our practical engineering education. Compared to our first car, the new Pegasus 2011 has reduced curb weight, a higher torque output, a more sensitive & lighter steering and an optimized chassis setup. With this new vehicle we're sure of achieving good results in the dynamic events and to impress the judges with clean engineering and fair car design. We are also looking forward to the static events, which received a lot more attention to detail this season.

FRAME CONSTRUCTION tubular steel frame

MATERIAL 1.0037 steel round tubing 25mm dia 1.5 to 2.5mm wall thikness

OVERALL L / W / H (mm) 2852 / 1426 / 1220

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1550 / 1220 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 134 / 174

SUSPENSION Double unequal length A-Arms. Push-rod actuated horizontal orientated coilspring and damper

TYRES (Fr / Rr) 205/510 R13, Continental / 205/510 R13, Continental

WHEELS (Fr / Rr) 7.0x13, 3.4mm offset, 2 pc Al/Mg rim / 8.0x13, -2.6mm offset, 2 pc Al/Mg rim

ENGINE 2000 Kawasaki ZX-6 4 Cylinder

BORE / STROKE / CYLINDERS / DISPLACEMENT 66mmmm / 43.8mm / 4 cylinders / 599cc

COMPRESSION RATIO 11,8:1

FUEL SYSTEM Student build fuel injection,

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE 20.20mm x 10.22mm cogged belt

DIFFERENTIAL clutch pack limited slip, 40 Nm preload,15.67 bias ration (DREXLER2009)

COOLING One side radiator; therm. contr. fans

BRAKE SYSTEM Hub mounted, hardened X46Cr13, 200 mm outer dia, 156 mm inner dia, solid,

ELECTRONICS electrical shifter, student built driver info system, bidirectional wireless modem, LiFePo Battery

HATFIELD

University of Hertfordshire

Car 57 Pit 47

United Kingdom

For the 2011 competition UH Racing has combined final year MEng/MSc students with level 4 BEng/BSc students to build a single Class 1 car, UH14. This combination has given the team the opportunity to design, test and develop a much wider range of concepts to a standard never before achieved, as well as having a broader and stronger knowledge base. The team have completed a kinematics and compliance test, a 7 post rig test along with fully testing last year's car UH13 to gain valuable data from the brand new electronics system developed for UH14. The 2011 competition truly has the potential as a year to be remembered. The merger of all our formula student activities into one team, the return of many team members from the highly successful UH12 team from industrial placements, our continued focus on the static events and our thorough testing plan will all combine to create the best opportunity UH Racing has had to be the first British team to win Formula Student Combustion.

FRAME CONSTRUCTION 2 piece steel tubular space-frame with bonded composite sandwich floor panels

MATERIAL C350 mild steel, cold drawn seamless tube

OVERALL L / W / H (mm) 2820 / 1425 / 1055

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1540 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 133 / 135

SUSPENSION Double unequal length A-Arm, front pull rod / rear push rod actuated spring and damper

TYRES (Fr / Rr) 20.5 x 7 - 13 R25B Hoosier / 20.5 x 7 - 13 R25B Hoosier

WHEELS (Fr / Rr) 7 inch wide, 2 pc Al Rim, 31mm pos. offset / 7 inch wide, 2 pc Al Rim, 31mm pos. offset

ENGINE Modified 2009 Yamaha YZF-R6

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.1:1

FUEL SYSTEM Life Racing F88 ECU with multi-point sequential fuel injection and COP ignition

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12500

MAX TORQUE DESIGN (rpm) 9500

DRIVE TYPE Single 520 chain

DIFFERENTIAL Student design Salisbury limited slip differential

COOLING Single side-pod mounted radiator 295x295x25mm

BRAKE SYSTEM Stainless steel, hub mounted, 4x 220 mm dia. drilled, adjustable brake balance

ELECTRONICS Solenoid actuated gear selector, wheel mounted Pi X-sport, live GSM telemetry, MIL spec wiring loom

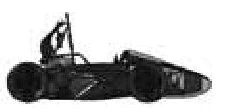
HELSINKI

Helsinki Metropolia University of Applied Sciences

Car 42 Pit 12

Finland

2011 Metropolia Motorsport designed and engineered its 9th Formula Student Car. HPF011 is built around the familiar concept of tubular steel space frame, 13" wheels and a four-cylinder engine and features fully stresses composite floorpan and side impact panels, completely custom made steering system and extensively modified Yamaha R6 engine.Suspension is designed with wide range of adjustments and pushrod actuated dampers are mounted up and horizontal in both ends. Steering wheel is connected to vehicle can bus allowing driver to adjust different parameters of the ECU or data acquisition. Four-speed gearbox is operated electro-pneumatically through steering wheel paddles.The whole beauty is wrapped in epoxy infused aramid fiber bodywork sketched by industrial design students.Metropolia Motorsport would like to than all it's sponsors and supporters for the season of 2011.



FRAME CONSTRUCTION Tubular steel space frame with composite stress panels

MATERIAL Ruukki Form 600, 22mm to 30mm dia. 200g twill carbon & aluminium honeycomb

OVERALL L / W / H (mm) 2635 / 1380 / 1155

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1550 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 118 / 145

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally mounted Cane Creek damper

TYRES (Fr / Rr) Hoosier 20.5 x 7 R13 R25B

WHEELS (Fr / Rr) 6x13, ET30, centerlock 3 pc Al Rim

ENGINE 2010 Yamaha R6

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.5:1

FUEL SYSTEM Student designed and manufactured with staged sequential injection

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 10700

MAX TORQUE DESIGN (rpm) 8300

DRIVE TYPE 428 Single row chain drive

DIFFERENTIAL 2010 Drexler limited slip differential, 6 different ramp angle setups

COOLING Single aluminum radiator on right side, PWM controlled fan and water pump

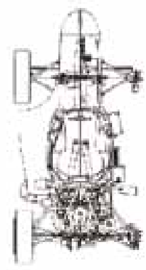
BRAKE SYSTEM Floating, hub mounted, laser cut steel, 195mm outer diam., 142mm inner diam.

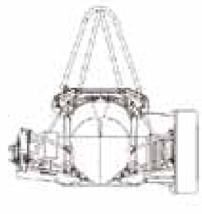
ELECTRONICS Electropneumatic shifting system, self-designed multifunctional steering wheel, CAN 2.0 A highspeed

ITHACA
Cornell University

Car 14 Pit 36 United States

ARG11 is Cornell University's entry for the 2011 Formula Student Germany competition. The design of ARG11 is based on a re-evaluation of vehicle fundamentals, especially those relevant to an FSAE car. Cornell Racing's goal is to have a reliable and consistent platform for validating the foundation principles of both the engine and vehicle dynamics.Cornell Racing believes the winning formula is a turbo charged four cylinder engine, combined with a hybrid monocoque/sub-frame chassis and 13 inch wheels.We are very excited to compete on our first ever FS Germany event, see you at the track!





FRAME CONSTRUCTION Prepreg carbon fiber one-piece monocoque with rear sub-frame

MATERIAL

OVERALL L / W / H (mm) 2503 / 1407 / 1174

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1575 / 1241 / 1194

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128 / 151

SUSPENSION Double unequal length A-Arms. Push rod actuated sring and damper

TYRES (Fr / Rr) 20.5x7-13 R25B Hoosier Fr & Rr

WHEELS (Fr / Rr) Three piece carbon fiber wheel with magnesium center

ENGINE Yamaha YZF-600R

BORE / STROKE / CYLINDERS / DISPLACEMENT 62.0mm / 49.6mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.0:1

FUEL SYSTEM Student designed/built, return fuel injection with Bosch 911 external fuel pump

FUEL E-85 ethanol

MAX POWER DESIGN (rpm) 7500

MAX TORQUE DESIGN (rpm) 6000

DRIVE TYPE DID 520 Chain

DIFFERENTIAL Kaaz clutch-type 1.5 way limited slip differential

COOLING Single sidepod mounted bespoke dual-pass radiator, electric pump,150 kPa max pressure

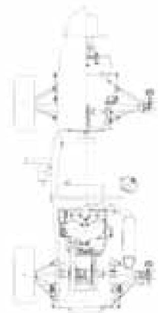
BRAKE SYSTEM 75-series master cylinders, calipers: Brembo P-34 (F), Wilwood PS-1 (R)

ELECTRONICS Student designed ECM, DAQ, dashboard, and fuse box

KAISERSLAUTERN
Technical University of Kaiserslautern

Car 64 Pit 45 Germany

The Kaiserslautern Racing Team was founded in 2007.In 2011, we are participating at the events of the Formula SAE with our 4th car, the CarboNyte 2011.This year's car features a full cfrp monocoque with integrated rearframe.As in the previous years, the engine is taken from the Suzuki GSX-R 600 and controlled by a trijekt ECU.The A-Arms are adhesively bonded to the wheel side aluminium socket.Kinematics are simulated with IPG CarMaker.
In the drivetrain, a Drexler limited slip differential is used to divide torque appropiately.We have the ability to log spring travel, wheel rotation speed, steering angle and car position (GPS) and to transfer it via GPRS to our server.It is our aim to compete in the events with a car that is simple, reliable and light and has been thoroughly tested in advance.We thank all our sponsors for their great support during this season and are looking forward to a challenging and successful season.



FRAME CONSTRUCTION One-piece monocoque, integral structure including rear frame

MATERIAL CFRP prepregs, foam Rohacell 51 WF-HT

OVERALL L / W / H (mm) 2870 / 1378 / 1202

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 159 / 159

SUSPENSION Double unequal length A-Arm. Pull rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 20.5x7-13 R25B Hoosier

WHEELS (Fr / Rr) 6x13, 2.5 in backspacing

ENGINE 2004 / 2005 Suzuki GSX-R 600

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13,5:1

FUEL SYSTEM Sequential fuel injection

FUEL ROZ 98

MAX POWER DESIGN (rpm) 12500

MAX TORQUE DESIGN (rpm) 9000

DRIVE TYPE 22mm chain drive

DIFFERENTIAL Drexler, clutch pack limited slip, 125 Nm preload

COOLING Single Radiator, mounted on the side, electrically controlled fan and waterpump

BRAKE SYSTEM 4-Disk system, self developed rotors / 220 mm outer dia / adjustable balance, 4 piston calipers

ELECTRONICS logging of spring travel wheel rotation, steering angle, GPS position via GPRS

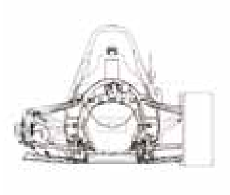
KARLSRUHE

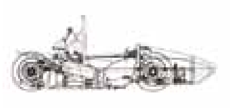
Karlsruhe Institute of Technology

Car 22 Pit 11

Germany

Being a team of about 50 students, KA-RaceIng builds two cars every year: one for the formula student and one for the formula student electric. Starting in autumn with conception and design, we set a tight production schedule to present our new cars in April. Since then we have tested a lot to get ready to race and train our drivers. The KIT11 is our 5th combustion car and combines the best of new ideas and approved concepts. One of the highlights is the hybrid chassis with a CRFP monocoque front end and a tubular space frame rear end. To facilitate the handling with the KIT11, we also improved our ergonomics. Again we used the Honda CBR600 engine, this time with a self-built dual fuel system. The modular electronic system has been completed with a live telemetry system to observe all dates while driving. Our aim is to score as much points as possible and achieve a top ranking overall. We would like to thank all supporters and are looking forward to an exciting event at Hockenheim.





FRAME CONSTRUCTION Monocoque front end and tubular space frame rear end

MATERIAL Carbon fibre reinforced plastic with structural foam / tubular steel space frame

OVERALL L / W / H (mm) 2732 / 1425 / 983

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1630 / 1220 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 118 / 143

SUSPENSION Double unequal length A-Arms. Pull (Fr) / push (Rr) rod actuated TRD damper with coil spring

TYRES (Fr / Rr) Hoosier 20.5x7-13 R25B / Hoosier 20x7.5-13 R25B

WHEELS (Fr / Rr) Student made CFRP rim 7x13

ENGINE Modified Honda CBR600F PC35 2003

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13:1

FUEL SYSTEM Student designed / built dual fuel system using Bosch ECU (multi point injection & direct injection)

FUEL 95 octane petrol

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE pneumatic actuated 4 speed gearbox

DIFFERENTIAL Drexler clutch pack limited slip differential, preloaded - adjustable bias ratios

COOLING One side pod mounted radiator, electrical fans & water pump with student designed controller

BRAKE SYSTEM Floating steel rotors, ISR four piston monoblock caliper

ELECTRONICS Student built modular and extensible control units. Integrated telemetry functions.

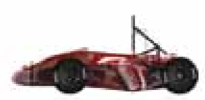
KARLSRUHE

University of Applied Sciences Karlsruhe

Car 16 Pit 67

Germany

Founded in 2006, Highspeed Karlsruhe is entering its 5th successful year of competition in Formula Student Germany, the 4th year in Formula ATA in Italy and the 1st in Spain. About 40 motivated students have worked together to develop the new cars, the F-105 and the E-105. The F-105 has been evolved from its predecessor, the F-104, by optimizing it even further. The F-105 boasts of a very short wheelbase along with a low centre of gravity, achieved by developing a completely new oil tank and an ultra compact oil pan. This along with the carbon-tube suspension and a rigid frame ensure even better drivability and faster cornering. A motorsport grade engine controller ensures a consistent power output both in maximum power and fuel efficiency mode. An advanced and stunning bodywork design has always been a trademark of the team. We would like to thank our sponsors and supporters, whose efforts are greatly appreciated, and are looking forward to a great competition in Hockenheim.



FRAME CONSTRUCTION Tubular space frame

MATERIAL E235+C round tubing with outer diameters of 26 to 30mm

OVERALL L / W / H (mm) 2535 / 1399 / 1095

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1530 / 1208 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 129 / 139

SUSPENSION Double unequal length A-Arm. Push rod actuated spring and damper

TYRES (Fr / Rr) 20.0/7.0-13, Avon A50

WHEELS (Fr / Rr) 7x13, 18mm offset, 2pc Al Rim

ENGINE Modified Honda CBR 600RR (PC37)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.0:1

FUEL SYSTEM OBR Euro-4, full sequential injection

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 9000

DRIVE TYPE Chain 520VM with X-Ring

DIFFERENTIAL Clutch pack limited slip, adjustable preload and bias

COOLING Left side pod mounted radiator with PWM controlled electric fan, electric pump

BRAKE SYSTEM 4-Disk system, self developed floating rotors 240/225mm diam., driver adjustable brake balance

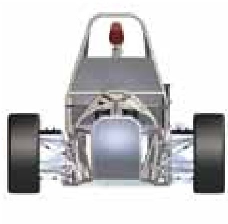
ELECTRONICS Wiring harness sealed to IP67, electropneumatic shifting, adjustable launch and traction control

KASSEL

University of Kassel

Car 28 Pit 75 Germany

The Herkules Racing Team was founded in 2009, and already from the very beginning we made it clear, that our aim is to build a simple and reliable car, characterised by some technological specialties. This year, we are glad to participate with our first car, SuzieQ. It is equipped with different sensors which are supposed to measure parameters like the temperature of the wheel bearings, the stress of the wheel hubs, the G-Forces acting on the driver etc. Important information is shown to the driver on the self-built steering wheel where the push buttons for the electronic gear shift system are attached to as well. In the unlikely case of significant electronic problems, the driver may also hit the Fail-Safe Button, which reduces the electronic system to its essential functions (e.g., gear shifting and ignition cut). This will ensure the drivability of SuzieQ. We would like to say thank you to all of our team's supporters who made our participation possible.



FRAME CONSTRUCTION Front and rear tubular space frame

MATERIAL E235 +C, EN 10305-1

OVERALL L / W / H (mm) 2801 / 1397 / 1175

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1206 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 130 / 195

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) Hoosier 20.5 x 7.0-13 R25B / Hoosier 20.5 x 7.0-13 R25B

WHEELS (Fr / Rr) 7x13, 5 mm offset, 4 pc Al Rim / 7x13, 31 mm offset, 4 pc Al Rim

ENGINE Modified Suzuki GSX-R 600 K7 DOHC

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,5:1

FUEL SYSTEM student designed batch fire injection

FUEL Gasoline

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 6000

DRIVE TYPE Nr. 525 Chain Drive

DIFFERENTIAL GKN Visko Lok, slip speed sensing. Modified for Chain Drive.

COOLING Twin side pod mounted radiators with thermostatic controlled electric fans

BRAKE SYSTEM 4-Disk system, hub mounted cast iron rotors (220mm outer diam.) 25mm floating dual piston

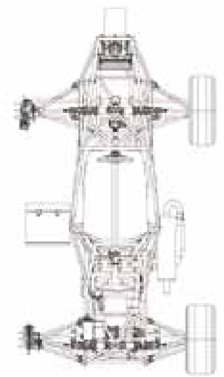
ELECTRONICS custom built data logger, CAN-Bus, electrical gear shifting, life video streaming

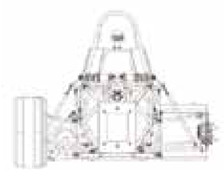
KEMPTEN

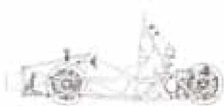
University of Applied Sciences Kempten

Car 100 Pit 77 Germany

The Infinity Racing Team was established in 2007 and today consists of about 40 highly motivated and dedicated students of the UAS Kempten. In this year's competitions we will present our third car, called TOMSOI III – „Top of the mountains, source of infinity". As we are always keen to improve ourselves every season, we integrated all our knowledge and skills in its design and construction. By using durable quality material in the whole car and a motorsport ABS we guarantee a high grade of security on the track as well as high reliability. Besides this, our car has a light tube frame, an adjustable pedalbox, a live telemetry system and many options to change the car's setup. The high agility, the fast shifting via paddles and the real racing sound of a four cylinder combustion engine contribute to the driver's fun factor.With this year's car we want to return to former success when we won the Best Newcomer Award in the German competition in 2008.







FRAME CONSTRUCTION Tubular Space Frame

MATERIAL Steel

OVERALL L / W / H (mm) 2765 / 1485 / 1127

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1280 / 1230

WEIGHT WITH 68kg DRIVER (Fr / Rr) 157 / 170

SUSPENSION ouble unequal length A-Arm. Push rod actuated lateral horizontal oriented spring and damper

TYRES (Fr / Rr) 205/510 R13 Continental 2011 / 205/510 R13 Continental 2011

WHEELS (Fr / Rr) Briad Formrace WHEEL 7

ENGINE 2003 Yamaha R6 RJ 09 4 cylinder DOHC

BORE / STROKE / CYLINDERS / DISPLACEMENT 65.5mm / 44.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.4:1

FUEL SYSTEM Student de1signed fuel injection system using Bosch MS4 ECU, sequential injection and ignition

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 9000

DRIVE TYPE chain drive/ 520 chain

DIFFERENTIAL Drexler clutch pack limited slip FS 2010,10Nm preload, 1200Nm maximum torque

COOLING One side mounted radiator

BRAKE SYSTEM 4-Disk system, self developed rotors with 230mm diameter, adjustable brake balance, ABS

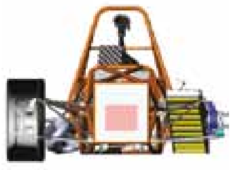
ELECTRONICS Student Built Telemetry system, streaming via ISM-Band, Electromagnetic Shifting System

KIEL

University of Applied Sciences Kiel

Car 53 Pit 27 Germany

Raceyard Kiel, the northernmost of the German Formula Student Teams, started to participate in Formula Student Events in 2006. After we had won four awards in the last years and were placed 9th in the last FSUK Event, the mission for this year is to take on the international Top-5. Therefore we have analysed last year's T-Kiel A 10 thoroughly and found a lot of potential for improvement. Also we have redesigned our team structure and all processes to increase the effectivity of our team work, improve the team documentation and create a sound team knowledge. New developments on our T-Kiel A 11 include an innovative intake system, which features a fully variable inlet port geometry in order to maximise the torque output over the whole rev band. This contributes towards the driveability of the car, but also reduces the fuel consumption. We are looking forward to the 2011 competition series and wish good luck to every team. We invite you all to visit our pit for further informations.



FRAME CONSTRUCTION Tubular spaceframe

MATERIAL Steel 25CrMo4/AISI 4130

OVERALL L / W / H (mm) 2785 / 1405 / 1053

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 135 / 153

SUSPENSION Double unequal length A-Arm. Push/Pull rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 7.0 / 20.0 - 13, Avon A50 front and rear

WHEELS (Fr / Rr) 7.0x13, 18mm offset, 5 pc hollow Al Rim front and rear

ENGINE Modified Honda CBR600RR (PC37)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 14:1

FUEL SYSTEM Student designed full sequential fuel injection system using Kawasaki Injectors and Euro 4 ECU

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE Chain Drive

DIFFERENTIAL GKN Salisbury type limited slip differential in lightweight aluminium housing

COOLING Single radiator with single fan mounted in left sidepod

BRAKE SYSTEM 4-Disk system,self developed rotos,235mm fr,215mm re,brake calipers with 4 pistons fr, 2 pistons re

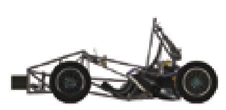
ELECTRONICS CAN Bus System, Shifting System, full variable air intake, multifuctional cockpit display

KONSTANZ

University of Applied Sciences Konstanz

Car 45 Pit 33 Germany

Founded in 2005 the Bodensee Racing Team consistently increased its car as well as in-house skills and expertise. With our 45 teammembers we're looking forward to a favorable season 2011 and a great Event in Hockenheim. We developed many parts of our last-season-car to construe a repeatedly effective and hopefully faster „Iltis11", our slightest car so far.With a weight of 220 kilogramm we reached our aim of a yearly lighter construction, among with a stainless steel frame. Furthermore our special hybrid wheel rim made of carbon and aluminium allow a new category of weight and speed possibility.We use to get powered by a modified Honda GSX-R-Engine with an 4-2-1 exhaust pipe system. The drivetrain assembly is fitted to the engine and supported at the rear frame tube, wich results in high stiffness and easy handling.The idea of our unique but already established steering concept was revised and improved while we maintained the basics for a functional guarantee.



FRAME CONSTRUCTION Tubular stainless steelroll bars

MATERIAL Stainless Steel V2A1.4301

OVERALL L / W / H (mm) 2801 / 1409 / 1069

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1620 / /

WEIGHT WITH 68kg DRIVER (Fr / Rr) 100 / 170

SUSPENSION Double unequal length A-Arm. Pull rods with horizontally damper, progressive tongue characteristic

TYRES (Fr / Rr) 20,5x7,0 13 Inch Hoosier / 20,5x7,0 13 Inch Hoosier

WHEELS (Fr / Rr) 7,0x13 OZ Racing Hybrid Aluminium Carbon

ENGINE Modified Honda GSX-R 600

BORE / STROKE / CYLINDERS / DISPLACEMENT 67,0mm / 42,5mm / 4 cylinders / 600cc

COMPRESSION RATIO 12,5:1

FUEL SYSTEM Modified fuel injector position

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 14000

MAX TORQUE DESIGN (rpm) 11500

DRIVE TYPE

DIFFERENTIAL Drechsler FS Differential

COOLING Rear mounted ooling radiator with integrated heat exchanger

BRAKE SYSTEM 4-Disk system with adjustable brake balance, front: 4 cylinders, rear

ELECTRONICS Multifunctional Steering Wheel, Selfdesigned sequential electric shifting system, MOSFET buildup

LATACUNGA

Army Polytechnic Institute

Car 99 Pit 24

Ecuador

We are very excited to be the first Ecuadorian team in design and build a Formula SAE vehicle, and is much more gratifying to know that this vehicle will participate in the competition Formula Studen Genrmay 2011. We have big expectations to know and learn from the work of other teams with more experience. Almost all of our vehicle was hand made manufactured. All the successes and especially the mistakes of the project have motivated us every day and although we carry the great responsibility of being the first South American team in participate, is indescribable the pride that we feel to be able to carry the name and a bit of the culture of our country to the competition.

FRAME CONSTRUCTION Tubular space frame

MATERIAL Mild Steel AISI 1020

OVERALL L / W / H (mm) 2760 / 1400 / 1285

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1660 / 1250 / 1210

WEIGHT WITH 68kg DRIVER (Fr / Rr) 150 / 170

SUSPENSION Double unequal length A-Arm Push Rod and double unequal length A-Arm Pull rod actuated.

TYRES (Fr / Rr) 155x60 R13 Hossier R25B/155x60 R13 Hossier R25B

WHEELS (Fr / Rr) 5.5x13/5.5X13 Aluminium Alloy

ENGINE 2006 Honda CBR600 F4i

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12:1

FUEL SYSTEM Multipoint Injection, Programmed Fuel Injection

FUEL Gasoline

MAX POWER DESIGN (rpm) 12500

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE 5,25 chain step

DIFFERENTIAL Torsen

COOLING Radiators with electric fan

BRAKE SYSTEM 4-Disks system, perfored rotors with 220mm diameter, adjustable brake balance, dual piston, Outlaw

ELECTRONICS Shifter pneumatic activated by a electro valve.

LECCE

University of Salento

Car 71 Pit 58

Italy

Salento Racing Team(SRT)represents much more than a simple group of students but an innovation lab in which skills and attitudes are emphasized. Thus, Engineering turns out magnified by matched efforts of different branches of knowing. In fact, the desire of reaching higher and higher results and to face newer and newer challenges are basic characteristics of SRT. In this context, SRT11 embodies an effective turning point in prototypes development, providing outstanding features such as a very stiff carbon fiber monocoque, important composite items (steering wheel, suspensions A-arms, fuel tank), gear & clutch pneumatic actuation, an optimized engine with customized head piston shapes and camshafts, launch control and much more. Eventually, SRT proudly represents a convergence point of some of the most innovative and competitive companies of our land, Salento. Hence, great expectation of an entire people encourages our steps to the success and we are keen on satisfying them.

FRAME CONSTRUCTION Carbon Fiber Monocoque

MATERIAL Sandwich made by CC201 Saati HS carbon fiber, Airex C70.55 PVC as core material

OVERALL L / W / H (mm) 2742 / 1444 / 1077

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1620 / 1240 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 127 / 158

SUSPENSION Double unequal length A-Arm. Front Push/Rear Pull rod actuated horizontally oriented spring&damper

TYRES (Fr / Rr) 20.5x7.0-13 HOOSIER R25B/ 20.5x7.0-13 HOOSIER R25B

WHEELS (Fr / Rr) 7.0x12, 22mm pos. offset, Al-Mg Rim/7.0x12, 22mm pos. offset, Al-Mg Rim

ENGINE Modified Honda CBR600F

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,8:1

FUEL SYSTEM Athena get data Walbro system with indirect sequential injection

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 7000

DRIVE TYPE Chain Transmission

DIFFERENTIAL Limited slip differential

COOLING Single260x460alum Rad with thermostatic controlled electric fans

BRAKE SYSTEM 4- Floating Disc System, 218mm diameter rotors, adjustable brake balance, APracing calipers

ELECTRONICS Multifunctional Steering Wheel, Electropneumatic shifting system,selfdesigned Telemetry System

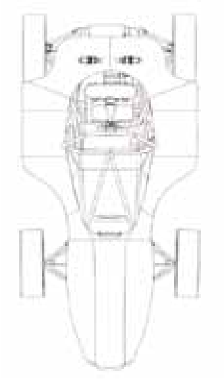
LIVERPOOL

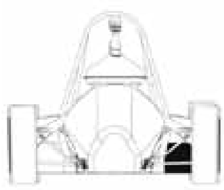
Liverpool John Moores University

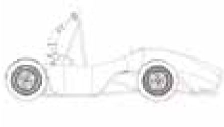
Car 32 Pit 63

United Kingdom

In 2010 LJMU racing team entered FSUK Class One for the first time and achieved a very respectable 21st place. This achievement was an inspiration to the current 2011 team which has managed to maintain many core members from 2010 and has recruited several keen new members. The strategy of the team is to incrementally improve the overall team entry by setting long term projects such as composite chassis panels, active suspension and heat recovery systems. The 2011 design team have been briefed with a strict weight budget for all components. This has resulted in none of the manufactured parts of the 2010 car being used on LJMU's 2011 entry. Comprehensive analysis has been undertaken to ensure a light yet reliable car. Quality and reliability is the forefront of the LJMU ethos and a full data acquisition package has been implemented and tested to ensure accurate data can be fed back and used in the design and analysis of all components.







FRAME CONSTRUCTION Tubular Spaceframe

MATERIAL Steel

OVERALL L / W / H (mm) 2630 / 1322 / 1104

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1185

WEIGHT WITH 68kg DRIVER (Fr / Rr) 119 / 179

SUSPENSION Double unequal length A-Arm. Pull rod/Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 6.0 x 20 x 13 A45 Avon

WHEELS (Fr / Rr) 150 mm wide, 3 pc Mg Rim

ENGINE Honda CBR 600 RR four Stroke in line four

BORE / STROKE / CYLINDERS / DISPLACEMENT 65.5mm / 44.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12:1

FUEL SYSTEM Honda Multi point fuel injection, DTA S80 Pro control

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12400

MAX TORQUE DESIGN (rpm) 8800

DRIVE TYPE 520 Chain

DIFFERENTIAL Drexler Limited Slip

COOLING Side pod mounted radiator with ECU controlled electric fan

BRAKE SYSTEM 4-Disk system, Front/Rear rotors diameter 247mm/220mm, adjustable brake balance

ELECTRONICS The ECU,Dash and GPS data logger connected over a high speed (500kb/s)CAN bus. Powershifter System

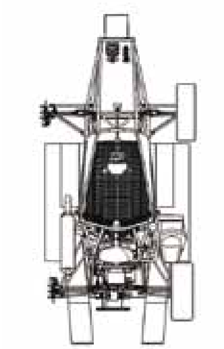
MADRID

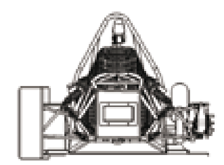
Polytechnic University of Madrid

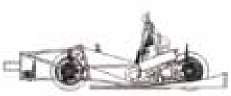
Car 86 Pit 6

Spain

The Technical University of Madrid (UPM) is the oldest and largest Spanish technical university, with a long tradition in the world of engineering from the 18th century. The UPM Racing team was born 8 years ago as a result of a joint effort between the Technical University of Madrid (UPM) and the University Institute of Automobile Research (INSIA) to provide the best training to their students. This year, the team presents a car based on its predecessor, the UPM007. All efforts are directed to two goals: improving performance and reliability. Among these improvements stands a significant weight reduction through the use of new materials in the frame and the optimization of material in all components of the car. In addition to this, the incorporation of a new differential and a new electronic control unit are the other important news on the way to achieve our goals. Of course, none of this could be possible without our principal sponsors: ETSII, FFII, Bosch, Caja de Ingenieros and RS.







FRAME CONSTRUCTION TIG welded steel tubular frame, sandwich carbon fiber floor boards and aluminum back plate

MATERIAL AISI 4130 steel, carbon fiber sandwich with PVC aircell core and 7075 T6 aluminum.

OVERALL L / W / H (mm) 3077 / 1404 / 1031

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1230 / 1160

WEIGHT WITH 68kg DRIVER (Fr / Rr) 130 / 159

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper.

TYRES (Fr / Rr) 20,5x6 R13 / 20,5x7 R13 Hoosier R25B

WHEELS (Fr / Rr) 6x13, -33mm offset, 2 pc Al-Mg Rim / 7x13, -2 mm offset, 2 pc Al-Mg Rim

ENGINE 2003 Yamaha R6

BORE / STROKE / CYLINDERS / DISPLACEMENT 65.5mm / 44.5mm / 4 cylinders / 600cc

COMPRESSION RATIO 12.4:1

FUEL SYSTEM Semi-sequential injection and wasted-spark ignition using BOSCH MS3-ECU and EV12 injectors.

FUEL 98 octane unleaded gasoline.

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 7000

DRIVE TYPE Chain

DIFFERENTIAL Drexler limited slip differential with internal preload adjustment.

COOLING Side pod mounted 900cc radiator and 260mm and thermostatic electric fan with forward and rear duct.

BRAKE SYSTEM 4-Disk system, rotors with 220mm diameter, adjustable balance bar and rear proportioning valve.

ELECTRONICS Electroneumatic Shifting, adjustable Traction Control and custom Telemetry System.

MAGDEBURG

Otto von Guericke University of Magdeburg

2011 is the second season of the "UMD Racing" - team, the Formula Student project at the Otto-von-Guericke-University Magdeburg. The main aim is to gain experience and come off well with the dynamic events successfully as opposed to the last year where our team participate in Italy. With over 70 students we made a big step forward, especially at the construction. So the focus at construction of the "UMD-FS2011" was on the left-side-concept by using the compact single-cylinder engine, which allows us to concentrate the inertia force around the vertical axis. To balance the car the driver position is decentralize. An another aspect was to reduce weight: This could be realized not only by using carbon fibre for structural elements like the steering wheel and the seat but also by optimisation with the finite elements methods for the pedals e.g. We would like to express our gratitude to all our sponsors and supporters which made it possible to build this car!

Car 34 Pit 15 Germany

FRAME CONSTRUCTION Tubular space frame

MATERIAL E235 steel round tubing

OVERALL L / W / H (mm) 2663 / 1445 / 1185

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1557 / 1532 / 1546

WEIGHT WITH 68kg DRIVER (Fr / Rr) 134 / 156

SUSPENSION Unequal length multilink axis with 4 track control arms and one steering link, Pull rod sytem

TYRES (Fr / Rr) 175-535 R13 Dunlop SP Sport

WHEELS (Fr / Rr) Keizer 6.0x13, 3 pc Rim with Al rim base and Mg star, 1,5 mm inset, 0mm offset

ENGINE Husaberg Fe550e

BORE / STROKE / CYLINDERS / DISPLACEMENT 100mm / 70mm / 1 cylinders / 550cc

COMPRESSION RATIO 11,3:1

FUEL SYSTEM Open-source MegaSquirt system with semi-sequential injection and wasted-spark ignition

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 8000

MAX TORQUE DESIGN (rpm) 6500

DRIVE TYPE chain drive, flank pitch: 520

DIFFERENTIAL Drexler differential, limited slip

COOLING Right side mounted radiator with thermostatic controlled fan

BRAKE SYSTEM Student built 210 mm & 190 mm dia.; Cast Iron, AP Racing18,3mm bore front / 21,8mm bore rear

ELECTRONICS Multifunctional steering wheel with integrated display, electric shifting system, CAN Bus

MANNHEIM

University of Applied Sciences Mannheim

This year is the second season for the Formula Student Team from University of Applied Sciences Mannheim. The team was founded in December 2008 and consists of around 25 highly motivated students working at the project. Our main goals for this season are a improved reliability and weight reduction. The most distinguishing feature of the DR11-TC is the in line drive train composed of a intercooled, turbo charched two cylinder 607ccm engine and separate 2 speed gearbox with limited slip salisbury differential. The tubular space frame was completely revised to bring more stiffness by less weight. Tight corners and a bumpy surface make high demands on the suspension system which is featured with anti dive and anti squat. Fabricated from carbon fibre and aluminium, a weight reduction of 30% is gained. An attached data logging system helps us to understand the car better and improve our engineering.

Car 68 Pit 51 Germany

FRAME CONSTRUCTION Front and rear Tubular space frame with square Bottom Profiles

MATERIAL 1.0037 25x1,5mm to 25x2,5mm and 25x25x1,25mm

OVERALL L / W / H (mm) 2820 / 1625 / 1275

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1643 / 1417 / 1317

WEIGHT WITH 68kg DRIVER (Fr / Rr) 199 / 201

SUSPENSION Double unequal length A-Arm with Push- rods. Dampers/springs diagonal behind gearbox

TYRES (Fr / Rr) 7.0/20.0-13, Avon A50 / A15

WHEELS (Fr / Rr) 8x13, 5mm neg. offset, 1 pc Al Rim

ENGINE Weber Motor / MPE 610 (Overhead Cam,Parallel Twin)

BORE / STROKE / CYLINDERS / DISPLACEMENT 85mm / 53.5mm / 2 cylinders / 607cc

COMPRESSION RATIO 10,2:1

FUEL SYSTEM Student design/built , Map based, multipoint electronic fuel injection

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 7000

MAX TORQUE DESIGN (rpm) 4500

DRIVE TYPE transaxle gearbox

DIFFERENTIAL Salisbury type limited slip differential, 60 degree ramp angle

COOLING One side mounted radiator with thermostatic controlled electric fans

BRAKE SYSTEM 4-Disk system, hub mounted, 250/220mm dia, floating wave disc

ELECTRONICS AIM EVO4 Data Logging, Quick Shifter ProShift PSU, LiFePo4 Battery

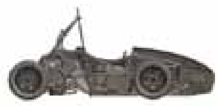
MARIBOR

University of Maribor

Car 20 Pit 61

Slovenia

In our first year, the main goal is to learn all the problems of being a Formula Student team. However, another goal is to try to be different and earn our space in a very competitive field - that is why our tubular spaceframe is made of aluminium, which is very rare at the competition. Regarding weight, rigidity and cost we see it as a sweet spot between carbon fibre and steel. High strength aluminium is also the main material for the majority of other components on the car, companied by carbon fibre (suspension arms), titanium (exhaust), steel and fibreglass. As the manufacturing process was performed with the help of local companies, the car is also a child of Slovenian industry. The team consists of around 25 students, young and determined enough to have a bright future in Formula Student.



FRAME CONSTRUCTION Aluminium tubular spaceframe

MATERIAL Aluminium 6061 T6

OVERALL L / W / H (mm) 2775 / 1395 / 1232

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1675 / 1200 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 103 / 175

SUSPENSION Double unequal length A-Arm. Pull rod actuated vertically oriented spring and damper

TYRES (Fr / Rr) 178x50 R13 Hoosier R25B / 178x50 R13 Hoosier R25B

WHEELS (Fr / Rr) 6 inch wide, 3 pc Al Rim, 25mm neg. offset

ENGINE Honda CBR 600RR, 2008

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mmmm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.2:1

FUEL SYSTEM Student des/built fuel lines, stock fuel injectors

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 9500

DRIVE TYPE Chain

DIFFERENTIAL GKN limited slip, student designed aluminium 7075 T6 housing

COOLING Sidepod mounted radiator and electric fan

BRAKE SYSTEM Brembo calipers, motorbike steel discs, Tilton master cylinders, student designed balance bar

ELECTRONICS E-motor driven variable intake runner length, E-motor driven quick-shift, dash LCD, telemetry

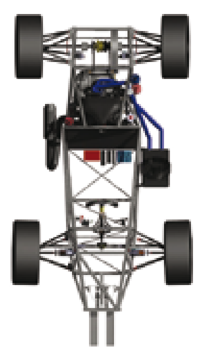
METZ

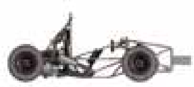
National Engineering School of Metz

Car 67 Pit 68

France

The ENIM Racing Team was established in 2008. It competed for the first time in the FSAE challenge in 2010. Composed of 6 members, the team has developed an all-new car for Class1. By building on knowledge gained from the previous competitions, the 2011 car has been designed to be even more efficient and effective. Our main goal was to reduce the weight down to 220kg, a significant drop of 25%. To do this we reconsidered the whole design philosophy; mostly by designing a lighter chassis (a 35% loss of weight), using lighter unsprung parts and transmission parts which represent our biggest weight reductions. The engine performances were also improved due to the design development of the intake, exhaust and cooling systems. The safety and environment of the driver were key factors in the design of our 2011 car. Due to our experience and improved engineering skills, ERT is hoping to retain its position as the No. 1 French team and to make a good impression in its first FSG competition .





FRAME CONSTRUCTION Tubular spaceframe

MATERIAL 4130 steel round tubing 25mm to 25,4 dia / 0,9 mm to 2,4 mm thk

OVERALL L / W / H (mm) 2850 / 1480 / 1005

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1710 / 1270 / 1220

WEIGHT WITH 68kg DRIVER (Fr / Rr) 148 / 148

SUSPENSION Double unequal length A-Arm, Öhlins TTX5 dampers

TYRES (Fr / Rr) 16/53-13 Michelin S6B

WHEELS (Fr / Rr) 8x13 Al Rim BRAID Formrace

ENGINE 2001 Honda CBR 600 PCE35 E

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12:1

FUEL SYSTEM Honda fuel pump, fuel injection system KMS MD35

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain #520

DIFFERENTIAL Drexler FSAE limited slip differentiel

COOLING Single student designed radiator munted in the left sidepode, electric fan

BRAKE SYSTEM Beringer 4 and2 piston calipers, Adjustable brake balance, AP Racing Master cylinders

ELECTRONICS KMS ECU and engine data acquistion system, AIM vehicle dynamic data logger

MILANO

Polytechnic University of Milan

Car 90 Pit 32

Italy

The aim of the team is to produce a lightweight, powerful and reliable car. The small, but technically strong, team (only 20 people) has worked hard to optimize each subsection through all the car: an extremely detailed CAD model and many hours spent on FEA and CFD simulation helped us to reach our objectives. The team has worked also on the reliability of the engine, an Aprilia RXV 550 V-Twin, which allows to have high torque from the lower rpm's till redline, but is a very sensitive engine. The suspension system is based on the old one, but is optimized for the new chassis, coupled with an innovative modular standalone data acquisition which guarantees a simple and rapid set up of the car. The strong reductions of wheight, although the chassis is a steel tubular one, and inertias complete the most competitive and well designed car ever conceived by the team. After the confirmation on the track of the performances of our small engineering jewel, Dynamis proudly presents its DPRC-XV011

FRAME CONSTRUCTION Tubular space frame

MATERIAL AISI 304

OVERALL L / W / H (mm) 2655 / 1440 / 1195

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1675 / 1280 / 1280

WEIGHT WITH 68kg DRIVER (Fr / Rr) 125 / 133

SUSPENSION Unequal length A-Arms. Push rod actuated. Ohlins spring/damper linear units. Anti roll bar.

TYRES (Fr / Rr) 20.5x7.0-13 Hoosier

WHEELS (Fr / Rr) OZ cast aluminum 13" x 6" +5mm offset

ENGINE Aprilia RXV550

BORE / STROKE / CYLINDERS / DISPLACEMENT 80mmmm / 55mmmm / 2 cylinders / 553cc

COMPRESSION RATIO 12.5:1

FUEL SYSTEM Student des/built ,fuel injection, semi-sequential

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 8900

DRIVE TYPE Chain #520

DIFFERENTIAL Bacci differential self-locking.Final drive ratio adj bt 2.92 - 3.23 by sprocket changes. Using 3.23

COOLING Twin side pod mounted radiators with thermostatic controlled electric fans.

BRAKE SYSTEM 2 Tilton master cylinders,mechanical bias bar,MQ Al Calipers,student designed rotors.

ELECTRONICS Dashboard, Gear control unit, Engine control unit, voltage regulator.

MOSCOW

Moscow State Technical University (MAMI)

Car 52 Pit 34

Russia

FS-MAMI has been active since 2007 and is the first Russian team whose car successfully completed the final endurance race. In 2008–2011 Formula Student MAMI is the best Russian team in the world ranking list of the FSAE teams.In concept of a new car we put such features that would allow us to not just finish the race, but fully demonstrate our competitiveness. While designing Iguana EVO 3, we set our main technical tasks of further weight reduction, lowering of the gravity center and increasing of power and reliability of the car overall. We have reached the goals by installation of the lubrication system with dry sump, modifying of monoshock suspension, improvement of intake and exhaust systems and adoption of new electronic system. 20 students were involved in the work on EVO 3. It allowed us to more thoroughly and comprehensively organize our work. We look forward to the opportunity to demonstrate our achievements and to represent Russia in Hockenheim.

FRAME CONSTRUCTION Tubular space frame

MATERIAL Steel 20 (round tubing 25 to 30mm outer diameter)

OVERALL L / W / H (mm) 2600 / 1420 / 1238

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1240 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 153 / 187

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented single spring and damper

TYRES (Fr / Rr) 205/510R13, Continental

WHEELS (Fr / Rr) 5.5x13, 35mm offset, forged Al rim

ENGINE Modified Honda CBR600F4i

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12:1

FUEL SYSTEM DTA S80Pro ECU,sequential fuel injection,190 CC/min Denso injectors

FUEL 98 octane

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain #520

DIFFERENTIAL Quaife limited slip differential

COOLING One side pod mounted radiator with ecu controlled electric fan

BRAKE SYSTEM 4-Disk system, rotors with 220mm outer diameter, 2-piston Wilwood calipers, adjustable brake balance

ELECTRONICS DTA S80Pro ECU, Electropneumatic Shifting System, Traction & Launch control

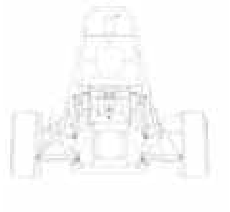
MUMBAI

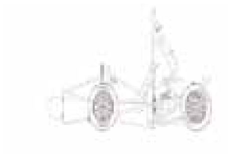
K. J. Somaiya College of Engineering

Car 77 Pit 72

India

ORI 11 known as the Aeton is the most ergonomically designed Indian Formula Student car. Equipped with latest technologies like Electronic shifter, Carbon Fibre Impact Attenuator and SLS Machined Air Box, the car is very stable, light weight, fast, reliable and safe. Extensive usage of Aluminium and Carbon Fibre has brought down the weight lower and also makes the car a very comfortable ride. Once you get in, you dont wanna get out! A 600cc Honda CBR engine drives the car generating a peak power of 77bhp. A Carbon Fibre steering wheel sandwiched with Aluminium is also one of the technical highlights! With all these features packed, the Aeton is only going to revolutionize Formula Student storming in as one of India's best contenders for the event!





FRAME CONSTRUCTION Steel Spaceframe

MATERIAL Mild Steel Pipes, 1

OVERALL L / W / H (mm) 2090 / 1565 / 1320

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1580 / 1340 / 1250

WEIGHT WITH 68kg DRIVER (Fr / Rr) 130 / 170

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper (coil-over).

TYRES (Fr / Rr) Continental 205/510 R13 / Continental 205/510 R13

WHEELS (Fr / Rr) 7x13, 20mm offset Al Rim / 7x13, 20mm offset Al Rim

ENGINE Honda CBR600 F4i

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.5:1

FUEL SYSTEM Stock Fuel Rail, fuel Injection, sequential

FUEL 98 Octane Unleaded Gasoline

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain Drive RK 520GXW

DIFFERENTIAL Clutch pack limited slip, 35Nm preload, 2.333:1 bias ratio

COOLING Single Radiator with Smart Controller, Craig Davies Thermatic Fan 8", 12V 75LPM

BRAKE SYSTEM 4-Disk system, rotors with 220mm(FR) and 218mm(RR) diameter, adjustable brake balance

ELECTRONICS LCD System, Shift Lights, GPS Assisted Data Logger into USB, Voice Telemetry, Electric Shifting

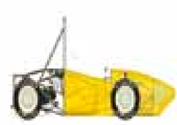
MUMBAI

M.H. Saboo Siddik College of Engineering

Car 13 Pit 40

India

Team MHSSC Racing INDIA is represented by an enthusiastic group of Automobile engineering students and this is our fresh attempt at the Formula Student after years of participation at the national level.This year's entry has been named the MHSSC-F11. Since we are a first year team, our main goal since the start this time around has been reliability and consistent performance.Our design has consistently concentrated on tried and tested methods with adoption of systems and assemblies that have been proven to perform time after time.Our design intention has been to produce a world-class competitive vehicle that will stand the test of time and most importantly be reliable and adjustable to tracks and track surfaces around the globe!



FRAME CONSTRUCTION Full body steel alloy tubular space frame

MATERIAL ASTM A106B & 1020 steel round & square tubing with variable cross-section

OVERALL L / W / H (mm) 2950 / 1495 / 1280

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1750 / 1300 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128 / 192

SUSPENSION SLA type A-Arm. Push rod actuated with horizontal spring and damper (coil-over). Adjustable.

TYRES (Fr / Rr) 178x54 R13, Hoosier R25B / 178x54 R13, Hoosier R25B

WHEELS (Fr / Rr) 7.0x13, 152.4 mm offset, 3 pc Al-Mg Rim / 7.0x13, 152.4 mm offset, 3 pc Al-Mg Rim

ENGINE Suzuki GSX-R600

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.5:1

FUEL SYSTEM Stock ECU and Fuel Injection System

FUEL 98 Octane Unleaded Gasoline

MAX POWER DESIGN (rpm) 8000

MAX TORQUE DESIGN (rpm) 6500

DRIVE TYPE 6-S Sequential manual with chain drive

DIFFERENTIAL Torsen Limited Slip Differential Type 1 University Special (012000) with custom housing

COOLING Double radiator with thermostatic controlled electric fan setup mounted in the left side pod

BRAKE SYSTEM Four cast iron rotors with 220mm OD, adjustable brake balance, 32mm double opposing piston callipers

ELECTRONICS Custom built Data logger, 16-CAN channels

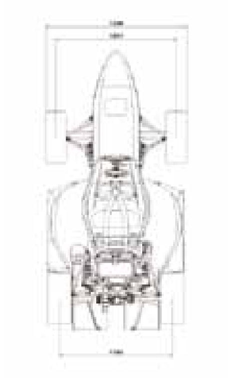
MÜNCHEN

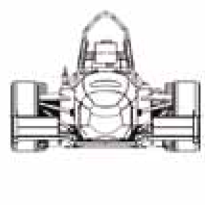
Technical University of München

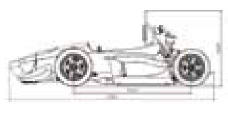
Car 7 Pit 42

Germany

In October 2010 a team of 36 young and motivated students started to develop the 8th car of the TUfast Racing Team. And after a lot of hard work we were proud to roll out the nb011 out of or shop in May 2011. In addition to a well designed car, last year´s season showed that a lot of car concepts can do well at a FSAE competition, as long as it is easily maintainable and reliable. So the challenge of 2011 was to build a well engineered and reliable car. Regarding that we came up with some good ideas for interesting parts for the nb011 and we are looking forward to Formula Student 2011. So now, we are excited to compete with all the other teams and get to know if we did a good job. And after a hard day full of work, we would be happy to chat with some of you guys about our favorite theme and having a good time. Just come over and visit us.







FRAME CONSTRUCTION CFRP Monocoque with aluminium sandwich with tubular steel rear space frame

MATERIAL HS Carbon fibre/Aluminium(5052) Honeycomb-Sandwich

OVERALL L / W / H (mm) 2790 / 1396 / 1034

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1610 / 1204 / 1124

WEIGHT WITH 68kg DRIVER (Fr / Rr) 127 / 136

SUSPENSION Double unequal length A-Arms. Pull rod actuated horizontally oriented TRD spring and damper units

TYRES (Fr / Rr) 20.5x7 - 13 Hoosier R25B / 20x7.5 - 13 Hoosier R25B

WHEELS (Fr / Rr) 7x13, 23.5mm offset, 1pc CFRP Rim / 7.5x13, 4mm offset, 1pc CFRP Rim

ENGINE Modified Kawasaki ZX600P ZX -6 R

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 14:1

FUEL SYSTEM Student designed fuel injection system using MoTec M800, 4 injectors close to inlet valves

FUEL 100 octane unleaded

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain #520

DIFFERENTIAL Drexler Torque sensitive limited slip differential with internal preload adjustment

COOLING Student designed radiator mounted in sidepod, electrical water pump and electrical fan

BRAKE SYSTEM 4-Disk system, self developed rotors with adjustable brake balance

ELECTRONICS multifunctional steering wheel, elctropneumatic shifting, several driver aids

MÜNCHEN

University of Applied Sciences München

Car 61 Pit 71

Germany

Founded in 2005 is municHMotorsport e.V. actually with 50 members heading to the events of the 2011 season. The team consists of students from different departments of our university. mechanical engineering, electrical engineering, business administration and more. Therefore we can fit the right persons to the needed tasks. The goal of our team is to build a competitive race car. Therefore we do not only want to show, what we as students are able to build, but also to present the Know - How we gained over the years. This year we put the most effort to reduce the weight of our car by 50kg. Furthermore we focused more on the static events and a good documentation to ensure the performance of our team for the next years.

FRAME CONSTRUCTION Handlaminated single part monocoque with including rear car section

MATERIAL SGL prepreg CE-8201-245-45S woven (245g/m2), CE-1222-255-37-HM UD (255g/m2), Nomex honeycomb(3-20mm)

OVERALL L / W / H (mm) 2735 / 1439 / 1116

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1540 / 1224 / 1168

WEIGHT WITH 68kg DRIVER (Fr / Rr) 124 / 146

SUSPENSION Double unequal length A-Arms. Pull rod actuated, horizontally oriented spring and damper

TYRES (Fr / Rr) 20.5x7.0 R13 Hoosier R25B

WHEELS (Fr / Rr) 7.0x13, 3 pc Al Rim, +18mm offset

ENGINE Modified Honda CBR600RR (PC40)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 15.6:1

FUEL SYSTEM student des/built, fuel injection sequential, Bosch EV14 injectors

FUEL 98 octane gasoline

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE Chaindrive with 520# Chain

DIFFERENTIAL Drexler Limited slip differential with clutch pack and adjustable preload

COOLING One side mounted self designed radiator with thermostatic controlled electric fan

BRAKE SYSTEM Floating stainless steel, hub mounted, 220mm dia., AP Racing Calipers, front 4x25.4 rear 2x25.4

ELECTRONICS

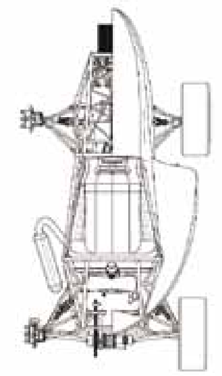
NEVERS

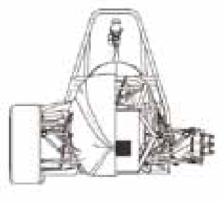
Institute of Automotive and Transport Engineering

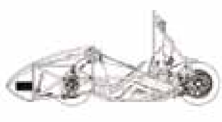
Car 58 Pit 65

France

ISAT Formula Student team was created in 2003, and is composed of 13 students in first year. The whole team is renewed each year and team members work on this project in parallel with attending mechanical engineering courses. The main purpose of this project is to enable students to discover how to design and build an entire car and how to work in an autonomous way. This year is very important for us because we have changed our engine and ECU system. We also tried to work hard on weight reduction in order to compensate the overweight of the new engine. We also decided to enlarge the car and to improve ergonomics for the driver. We thank all of our sponsors and will be doing our best to embrace the best results we can this summer.







FRAME CONSTRUCTION Tubular space frame

MATERIAL TU 37

OVERALL L / W / H (mm) 2600 / 1408 / 1158

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1550 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 131 / 166

SUSPENSION Double unequal length A-Arm. Pull rod actuated verticallyally oriented spring and damper

TYRES (Fr / Rr) Hoosier R25B 20.0x7.0-13 / Hoosier R25B 20.0x7.0-13

WHEELS (Fr / Rr) 7.0x13, 120mm offset, 3 pc Al Rim / 7.0x13, 120mm offset, 3 pc Al Rim

ENGINE 2008 Yamaha XJ6 4 cylinder

BORE / STROKE / CYLINDERS / DISPLACEMENT 65.5mm / 44.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.2:1

FUEL SYSTEM Student designed/built fuel lines

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE Chain #520

DIFFERENTIAL Drexler limited slip differential

COOLING One radiator mounted in sidepod + electric fan

BRAKE SYSTEM Student design rotors with 200mm diam., adjustable brake balance, calipers with opposing piston

ELECTRONICS Bosch MS4 DataLogger, NI compactRIO data acquisition and Electropneumatic Shifting System

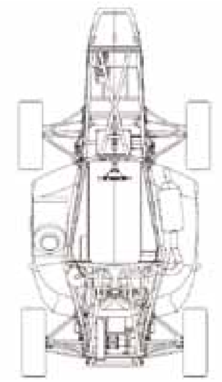
ODENSE

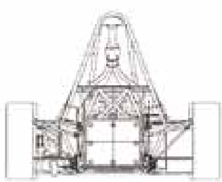
University of Southern Denmark

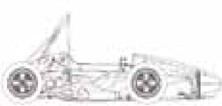
Car 30 Pit 73

Denmark

SDU-Vikings is a dynamic team of about 40 students. The team participates with a class 1 car for the fourth year this year. The main features on Viking IV are the cost efficient design without compromising weight or strength and the student build electronic system. The cost efficient design is obtained by having four corner symmetric uprights, hubs, and brakes, side to side symmetric a-arms and a tubular space frame chassis. The student build electronic system consists of an ECU, dashboard, powerbox, network, data logger and a gear and cluch system. Both the hardware and software are designed, build and programmed by the students. Viking IV has launch control, traction control and ignition cut-off gear change. These features can be turned on/off by the driver and the traction control is adjustable. Other new features on Viking IV:• Dry sump oil system• Pull rods• Camper adjustment• Increased engine compression ratio• Optimized intake/exhaust flow• Carbon plenumchamber







FRAME CONSTRUCTION Steel tubing space frame.

MATERIAL S 235

OVERALL L / W / H (mm) 2745 / 1426 / 1112

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1540 / 1250 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 158 / 150

SUSPENSION Double unequal length A-arm. Pull rod actuated horizontally oriented spring and damper (coil-over)

TYRES (Fr / Rr) 20.5x6.0-13. Hoosier R25B

WHEELS (Fr / Rr) 13

ENGINE Modified Honda CBR600RR

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,5:1

FUEL SYSTEM Student built/designed fuel injection system and ECU

FUEL E85 Bioethanol

MAX POWER DESIGN (rpm) 10000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE #525 DID Chain. Renthal rear sprocket.

DIFFERENTIAL Drexler LSD 2010/11 V3, Formula student Differential.

COOLING Left side pod mounted, custom made Nissen radiator. Pacet 225mm fan.

BRAKE SYSTEM 4 student designed fully floating hub mounted rotors. ISR 22-048, 4 piston calipers.

ELECTRONICS Student designed/built ECU, data logger, dashboard, LiveView program and visualization website.


www.career.daimler.mobi

OFFENBURG

University of Applied Sciences Offenburg

Car 44 Pit 52

Germany

We have built our Formula student car to build a car which is a harmony from weight, performance, driving dynamics and functionality. The frame is from structural steel, loads last around the high one to withstand the journey.All other parts were established from very light materials like aluminum or Carbon. We have decided to obstruct Suzuki 4 time engine with 600 cc and 85 hp. Injection, intake and exhaust system developed themselves, manufactured and coordinated completely.Many parts, such as pedal system, rear wing, chain adjuster, drive shafts and shock absorber, were developed, manufactured and then tested in the workshops university of their own completely themselves.

FRAME CONSTRUCTION Steel frame

MATERIAL S235JR

OVERALL L / W / H (mm) 2928 / 1600 / 1262

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1100

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128 / 192

SUSPENSION self-made air suspension strut, completely adjustable

TYRES (Fr / Rr) Hoosier 20,5x7,0-13 on all four wheels

WHEELS (Fr / Rr) BBS 6,0 x 13"

ENGINE Suzuki GSX-R 600 K4

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,5:1

FUEL SYSTEM

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 12000

DRIVE TYPE Drive Chain

DIFFERENTIAL Drexler Limited Slip Differential FS 2010 V3

COOLING Two side mounted mini radiators

BRAKE SYSTEM 4-Disk system with selfmade brake bias adjuster and AP RACING brake calipers

ELECTRONICS electrical shifting system, telemetry system with GPS

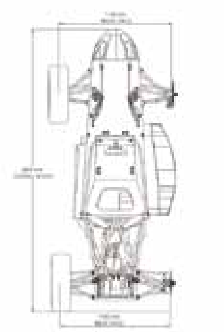
OXFORD

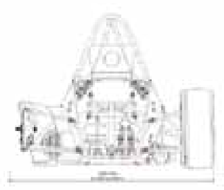
Oxford Brookes University

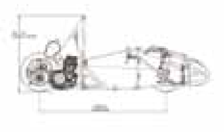
Car 17 Pit 18

United Kingdom

Oxford Brookes University presents ISIS-XI „Alice" for the 2011 Formula Student Germany competition. We believe performance, reliability, ease of driving, and safety to be key components of a Formula Student car design. As such, we have developed ISIS-XI to meet all of these goals with as few compromises as possible. ISIS-XI features many entirely redesigned components and innovative manufacturing techniques. One such innovation for ISIS-XI is a folded aluminium monocoque with hard-points integrated in a sandwich panel construction. In order to reduce driver fatigue the steering and upright geometry have been tuned to reduce steering effort. The KTM 530 EXC has been selected due to its low mass, smooth torque characteristics, and good fuel economy. Additionally the unsprung mass has been drastically reduced through the use of carbon fibre wheel shells, as well as a redesigned upright and brake package. For more information join the Oxford Brookes Racing fan page on Facebook.







FRAME CONSTRUCTION Aluminium monocoque forward of main roll hoop, tubular spaceframe behind main hoop

MATERIAL Alloy steel, aluminium sandwich panel

OVERALL L / W / H (mm) 2475 / 1325 / 962

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1150 / 1100

WEIGHT WITH 68kg DRIVER (Fr / Rr) 114 / 123

SUSPENSION Double unequal length a-arm / push rod actuated springs and dampers

TYRES (Fr / Rr) 6.2/20.0-13 Avon A45

WHEELS (Fr / Rr) 3 piece rim; carbon fibre wheel shell with aluminium centre

ENGINE 2008 KTM 530 EXC

BORE / STROKE / CYLINDERS / DISPLACEMENT 95mm / 72mm / 1 cylinders / 510cc

COMPRESSION RATIO 11.9:1

FUEL SYSTEM Student designed and built fuel injection

FUEL 100 octane

MAX POWER DESIGN (rpm) 8500

MAX TORQUE DESIGN (rpm) 5500

DRIVE TYPE 520 steel chain

DIFFERENTIAL Drexler chain driven limited slip differential

COOLING Sidepod mounted radiator with thermostatic controlled electric fan

BRAKE SYSTEM Cast iron rotors / AP Racing master cylinder & rear calipers / ISR front calipers

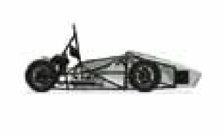
ELECTRONICS MoTeC M800 ECU

PADOVA
University of Padova

Car 85 Pit 76

Italy

The RaceUP Team from the University of Padova is at its sixth year involvement in the Formula Studentworld. Like two years ago, the team decided to build a totally new car in order to improve the good solutionsand correct the bad ones adopted in the past years of competitions. At the same time the team used the lastyear car to collect useful informations about those aspects of the dynamic behavior that hardly can be foundusing simulations only. The main aim for this year was to make a race car, i.e. a simply, efficient, lightweightand reliable car. To reach these goals a significant design effort has been made, in order to lower the totalnumber of parts as well as their weight. This philosophy has been transferred to each subsystem design.Main features are a redesigned stiffer frame, a new suspension system designed to eliminate understeering behaviours, a more powerful engine, an improved drivetrain system with clutch pack limited slip differential and an aggressive bodywork.



FRAME CONSTRUCTION Tubolar space frame

MATERIAL 25CrMo4 Steel

OVERALL L / W / H (mm) 2736 / 1446 / 1027

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1260 / 1230

WEIGHT WITH 68kg DRIVER (Fr / Rr) 127 / 146

SUSPENSION Double unequal length A-Arm. Pull-rod to bell-crank, horizontally oriented spring and damper

TYRES (Fr / Rr) 20.5x6.0-13 R25A Hoosier / 20.5x7.0-13 R25A Hoosier

WHEELS (Fr / Rr) 13" ET33 Magnesium / 13" ET43 Magnesium

ENGINE Honda cbr 600 rr p40 2007

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13,8:1

FUEL SYSTEM Athena/get sequential fuel injection

FUEL 98 RON unleaded gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE chain 520

DIFFERENTIAL clutch pack limited slip with 0 Nm preload

COOLING Single external radiator with controlled electric Fan

BRAKE SYSTEM 4-Disk system, self developed rotors with 220mm diameter, adjustable Fr/Rr balance, brembo calipers

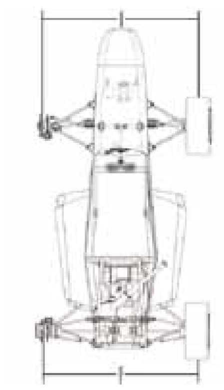
ELECTRONICS wiring harness sealed to GET MD3, multifunctional dashboard, electropneumatic shifting System

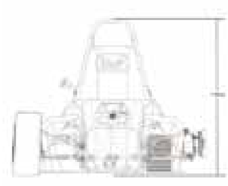
PATRAS
University of Patras

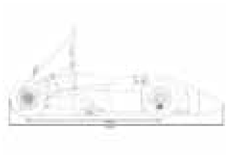
Car 87 Pit 69

Greece

UoP Racing Formula Student team presents his fourth race-car "UoP3EVO, a further developed car of its predecessor. The prominent features are the "hybrid" CF monocoque chassis reinforced with aluminum plates, a new designed easy-to-tune suspension system with better packaging, a self-developed gear shifting mechanism(drill shifter) utilizing a DC motor coupled to a planetary gear reduction system, a more sophisticated car monitoring system and a powerful, yet lightweight engine Yamaha WR450F. During the design and development of UoP3EVO the UoPRacing team had always in mind to find solutions being simultaneously SIMPLE- EFFICIENT- RELIABLE and COMPETITIVE. As a result UoP3EVO is a car focusing on high performance, easy-tuning and reliability.We would like to thank the Laboratory for Manufacturing Systems & Automation (LMS) of the Patras University, along with our sponsors for their support that's giving us the chance to experience this motorsport challenge.







FRAME CONSTRUCTION Two piece carbon fiber monocoque with aluminum reinforcements

MATERIAL Carbon fiber cloth, epoxy resin, Airex/aramid honeycomb core, 2mm aluminum plates

OVERALL L / W / H (mm) 2670 / 1431 / 1146

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1240 / 1220

WEIGHT WITH 68kg DRIVER (Fr / Rr) 122 / 126

SUSPENSION Double unequal length A-Arm. Push rod actuated vertically oriented spring and fully adj. damper

TYRES (Fr / Rr) 18x7.5-10 R25B Hoosier slicks / 19.5x6.5-10 Hoosier wets

WHEELS (Fr / Rr) 7.5 inch wide, 3 pc Al Rim, custom Al center

ENGINE 2008 Yamaha WR450F

BORE / STROKE / CYLINDERS / DISPLACEMENT 95mm / 63.4mm / 1 cylinders / 449cc

COMPRESSION RATIO 12.3:1

FUEL SYSTEM Haltech E6X ecu, Keihin pump and injector, direct fire ignition

FUEL 98 Octane Unleaded Gasoline

MAX POWER DESIGN (rpm) 9300

MAX TORQUE DESIGN (rpm) 7000

DRIVE TYPE DID ERV 520 chain

DIFFERENTIAL Drexler LSD - Formula Student special, Salisbury type

COOLING Sidepod mounted radiator, 180mm electric fan, 1.1bar pressure relief cap

BRAKE SYSTEM 4-disk system, 180mm drilled floating rotors, 4-piston monoblock calipers, 3-pedalbox, braided lines

ELECTRONICS Self designed shifting system, steering wheel mounted multi dunction display

PISA
University of Pisa

The E-Team Squadra Corse is the Formula Student team of the University of Pisa. It was established in 2007 and, currently, it has 30 members. Its fouth car, the „ET4“, is designed and assembled with great attention to ergonomics, but always achieving reliability, safety, lightweight and, of course, great performances.ET4 is powered by an Aprilia SXV 5.5 twin cylinder engine and it is equipped with magnesium wheels, carbon fiber suspension arms and axle shafts. The car has an advanced electronic system for gear shifting, data acquisition and telemetry. For futher information visit our website at www.eteamsquadracorse.it

Car 39 Pit 14

Italy

FRAME CONSTRUCTION Tubular Space Frame, TIG welding

MATERIAL AISI 4130 steel round tubing, 1.125" dia / 1" dia / 5/8" dia, various thickness

OVERALL L / W / H (mm) 2630 / 1388 / 1020

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1640 / 1220 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 140 / 133

SUSPENSION Double unequal length A-Arm. Push rod actuated laterally oriented spring-dampers; anti-roll bar

TYRES (Fr / Rr) 20.5X 7.0-13 Hoosier R25B

WHEELS (Fr / Rr) 7" wide, 43,25 mm offset, 1 pc Al Rim / 7" wide, 43,25 mm offset, 1 pc Mg Rim

ENGINE 2010 Aprilia 550 SX

BORE / STROKE / CYLINDERS / DISPLACEMENT 80.0mm / 55.0mm / 2 cylinders / 549cc

COMPRESSION RATIO 12,0:1

FUEL SYSTEM 2 Delphi injectors coaxial with intake manifold, Port Injection

FUEL 100 Octan, Gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 9000

DRIVE TYPE Aprilia 520 chain size

DIFFERENTIAL Drexler, clutch pack limited slip

COOLING Double side pod mounted radiator with thermostatic controlled electric fan

BRAKE SYSTEM 4-Disk system, Fixed Rotors, Steel, hub mounted, 240 mm outer dia., 180 mm inner dia.

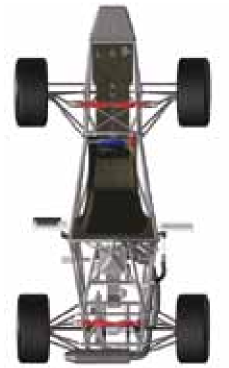
ELECTRONICS Athena HPUH4 ECU, student-built Electropneumatic GCU and Telemetry, RT DL1+DASH3 Logger/Display

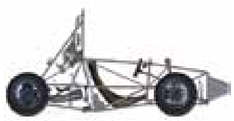
PORT ELIZABETH
Nelson Mandela Metropolitan University

Nelson Mandela Bay, located on the sunshine coast at the southern tip of Africa, is home to NMMU Racing which was formed with the goal of being the first South African team to build and race a Formula Student vehicle. Formula for Success has been the motto that we have adopted throughout the construction of DIBA01. Almost three years later, we are proud to have the opportunity to achieve this objective by competing at FSG 2011. Our vehicle follows a classic Formula Student design philosophy of tubular space frame with pushrod-actuated double-wishbone suspension and a Honda 599cc 4 cylinder engine. We have, however, been fortunate to include some distinctive features on the vehicle such as a unique intake manifold design, electronic data acquisition system and retro styling. This project has given us, a multi-disciplinary team, the opportunity to gain unparalleled experience in vehicle engineering; it has added the challenge of putting our designs to the test on the race track.

Car 27 Pit 49

South Africa





FRAME CONSTRUCTION Tubular space frame

MATERIAL Chromoly Steel

OVERALL L / W / H (mm) 2900 / 1400 / 1360

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1700 / 1220 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 141 / 169

SUSPENSION Double unequal lenngth A-arms. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) Continental, 205/510 R13

WHEELS (Fr / Rr) Magnesium Aloy, BBS, 8.0x13

ENGINE 05/06 Honda CBR600 RR03

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,0:1

FUEL SYSTEM Student designed rail with multi point fuel injection and wasted-spark ignition

FUEL 95 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE Chain #520

DIFFERENTIAL Drexler LSD

COOLING CHE custom radiators, two in either sidepod, ECU controlled electric pump and fans

BRAKE SYSTEM 4-Disk system, student made solid disks (Benox), Wilwood calipers, 250mm/228mm

ELECTRONICS Electromechanical Shifting System, Data Acquisition, Multifuncional Steering Wheel

RAVENSBURG

Baden-Württemberg Cooperative State University Ravensburg

Global Formula Racing is the first innovative global collaboration of its kind in the history of both, the US-based Formula SAE and the EU-based Formula Student programs. The former BA-Racing-Team from the Duale Hochschule Baden-Württemberg (DHBW-RV), and the Beaver Racing team from Oregon State University (OSU) have combined forces to compete as a single entity in 2010. The two universities since then share physical and intellectual resources to create a highly competitive vehicle worthy of international reputation. In 2011, we will reconfirm our successful season from 2010. This will be achieved by using the effective 2010 basis and build one car with a combustion drivetrain, and one car with an electric drivetrain. The combustion car will be manufactured and tested at the OSU campus in Corvallis, Oregon, USA and the electric powered car at the DHBW-RV, Friedrichshafen, Germany. Both cars will compete side by side.

Car 21 Pit 19 Germany

FRAME CONSTRUCTION Full Carbon Fiber Monocoque / Steel Roll Hoops

MATERIAL Toray T700SC-12k-50C#2510 Plain Weave Fabric, Flexcore nomex honeycomb, 1020 DOM mild steel

OVERALL L / W / H (mm) 2912 / 1328 / 1150

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1555 / 1120 / 1120

WEIGHT WITH 68kg DRIVER (Fr / Rr) 101 / 123

SUSPENSION Double unequal length A-Arm. Push- and pull rod actuated spring and damper

TYRES (Fr / Rr) Hoosier 6.0/18.0-10

WHEELS (Fr / Rr) Hoosier 6.0/18.0-10

ENGINE Honda CRF 450x

BORE / STROKE / CYLINDERS / DISPLACEMENT 96mm / 62mm / 1 cylinders / 449cc

COMPRESSION RATIO 12.0:1

FUEL SYSTEM Honda fuel pump, Bosch 945 injector, custom rail, full sequential

FUEL 98 octane

MAX POWER DESIGN (rpm) 9100

MAX TORQUE DESIGN (rpm) 9100

DRIVE TYPE 520 chain

DIFFERENTIAL clutch pack limited slip, adjustable preload preload, lockable

COOLING Side pod mounted radiator with ECU controlled electric fan

BRAKE SYSTEM 4 brake system, self developed cast iron rotors

ELECTRONICS Student designed computer, launch and traction control, multifunctional steering wheel, telemetry

REGENSBURG

University of Applied Sciences Regensburg

The season theme for our fourth formula student season and our fourth formula student combustion race car is "evolution not revolution". The Dynamics e.V. of the University of Applied Sciences in Regensburg was founded in 2006 by 20 dedicated students and meanwhile sums up to more than 50 race car enthusiastic team members from every faculty. This year's car is based on the experience of the last cars and was built to improve the performance and design. We proudly present the car for the season 2011: the RP11c! The intention of a perfect race car has changed over the years and we improved a lot. This year's design is driven to provide a perfect working environment for our drivers. Some specials are a lightweight construction with a maximum effort in safety for the driver, ergonomically optimised seat, pedals and steering wheel position and a highly optimised powertrain concept.

Car 62 Pit 59 Germany

FRAME CONSTRUCTION Tubular space frame with carbonfibre sandwich floor panels

MATERIAL s235, steel round tubing

OVERALL L / W / H (mm) 2715 / 1500 / 1069

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1575 / 1458 / 1410

WEIGHT WITH 68kg DRIVER (Fr / Rr) 85 / 115

SUSPENSION Double unequal length A-Arm with anti-dive. Pushrod actuated y-axis oriented spring and damper

TYRES (Fr / Rr) 205/510 R13 34M Continental

WHEELS (Fr / Rr) 205/510 R13 34M Continental

ENGINE Modified Honda CBR600RR (PC37) Inline 4 cylinder

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.1:1

FUEL SYSTEM Student built ,fuel injection in air box, using Bosch MS4 ECU

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE Synchronous Belt Pitch

DIFFERENTIAL Limited Slip Differential

COOLING Rear mounted, 889cc mini radiator with 167mm electric fan, self designed cooling controller

BRAKE SYSTEM 4-Disk system, self developed rotors with 245mm diameter, adjustable brake balance,

ELECTRONICS wiring harness layout in CAD, Multifunctional Steering Wheel with paddels, Electropneumatic Shifting

ROCHESTER

Rochester Institute of Technology

Car 5 Pit 26

United States

Rich with history and tradition, the RIT Formula Racing Team has competed in 36 Formula SAE and Formula Student competitions on three different continents. In 19 years, RIT has been awarded numerous accolades, including overall titles in the US, England, and Australia. During the 2010 competition season the team was able to place among the top 5 in each of the 3 competitions attended including a victory at FSAE West. This year marks a milestone for RIT FSAE with two major changes: a carbon fiber monocoque front half and a new powerplant, the 2008 Yamaha YZF-R6R. Accompanying these changes is a completely RIT designed braking system, a unique differential, the Torvec IsoTorque, a refined aerodynamics package, and a number of driver aids including paddle shifting, hand clutch actuation, and traction and launch control.

FRAME CONSTRUCTION Front: Carbon fiber monocoque; Rear: Steel tube frame

MATERIAL Front: Carbon fiber pre-preg and aluminum honeycomb core; Rear: 4130 Chromoly steel tube

OVERALL L / W / H (mm) 2490 / 1423 / 1148

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1575 / 1220 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 129 / 143

SUSPENSION Double unequal length A-Arms. Pushrod actuated spring and damper

TYRES (Fr / Rr) 20.0X7-13 Goodyear D2696 / 20.0X7-13 Goodyear D2696

WHEELS (Fr / Rr) 7x13, 63mm pos. offset, 3 pc Al Rim / 7x13, 63mm pos. offset, 3 pc Al Rim

ENGINE 2008 Yamaha YZF-R6R

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.1:1

FUEL SYSTEM RIT designed/built, multiport sequential injection, MoTec ECU engine management

FUEL 93 octane unleaded gasoline

MAX POWER DESIGN (rpm) 13000

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE Single Reduction Chain Type

DIFFERENTIAL Limited Slip, Torvec IsoTorque gearset, RIT-Designed housing, 8:1 bias ratio

COOLING Dual-Pass RIT Designed aluminum radiator mounted to side of chassis using structural hroud

BRAKE SYSTEM RIT designed calipers (Pistons: 4(F), 2(R)), RIT designed vented front rotors, adjustable pedal box

ELECTRONICS Traction and launch control, GEMS DA99-2 data logger, electropneumatic shifting and clutch systems

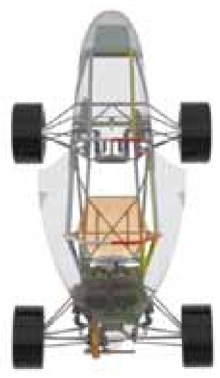
ROMA

Sapienza University of Rome

Car 19 Pit 53

Italy

Sapienza Corse's vision has a name, "Gajarda". She tasted the track for the first time in 2008, and then she never stopped. In three years of competitions "Gajarda" got better and better, both in reliability and performances, being able to reach her best results in FSAE Italy 2010 (14th place on 45 teams), with a 1st place overall in the Cost Event, a 5th place overall in the Presentation Event, resulting the first Italian team in 4 competitions out of 8. But the past now is gone, and the best is yet to come. At her 4th season, her main objectives are still the same: a vehicle entirely built by the students, characterized by extremely high performances and low weight. New items such as carbon fiber home-made rims, electronic differential and four-gears box with electronic self designed actuator are just a few examples of what "Gajarda 2011" is going to offer to all of her supporters (...and competitors!). Sapienza Corse's definitely ready for FSG2011...what about you?



FRAME CONSTRUCTION Tubular space frame, alluminium subframes

MATERIAL Mild steel round tubing 25 mmm dia / AL 6082 aluminium

OVERALL L / W / H (mm) 2700 / 1309 / 1000

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1590 / 1150 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 133 / 162

SUSPENSION Double unequal length A-Arm. Pull rod actuated longitudintally oriented spring and damper, anti-rol

TYRES (Fr / Rr) 205x510 R13 Continental/205x510 R13 Continental

WHEELS (Fr / Rr) 7x13, 25 mm offset, Carbon Fiber Rim/7x13, 25 mm offset, Carbon Fiber Rim

ENGINE Modified Honda CBR 600F

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,00

FUEL SYSTEM Electronic Injection Mectronik MKE6

FUEL 98 Octane Unleaded Gasoline

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE 4/8" Chain Drive

DIFFERENTIAL Open Differential, Electronic self-locking control , Dinamically variable bias ratio.

COOLING Twin parallel radiators, electtric pump, electronic flow controller, controlled fan.

BRAKE SYSTEM 4-Disk System, Floating,Steel, 240 mm diam. front hub mounted/190 mm diam. rear diff housing mounted

ELECTRONICS Mectronik MKE6 ECU, Electronic Shifting System, Electronic Differential Control

SINT-KATELIJNE-WAVER

Lessius Mechelen University College - De Nayer

Car 37 Pit 7

Belgium

Lessius Racing Team consists of both engineering and bachelor students, so a mixture of theoretical knowledge and practical skills is achieved. The car is build around a lightweight aluminium spaceframe to minimize fuel consumption, and runs on bio-ethanol E85. The engine is a four-stroke engine from a Honda CBR 600RR, and operates with a self-designed intake and exhaust system. The power generated by the engine is transferred to the rear wheels by a Drexler differential and a single-chain transmission. The steering wheel of the car is designed to cooperate with the Main Control Unit to ensure that the driver can access critical information via the display. To further decrease the weight, the suspension is primarily constructed out of carbon fiber and aluminium, while the body is mainly manufactured from glass fiber.The goal of the team is to get the best possible result in both static and dynamic events, to pave the way for future teams of Lessius Mechelen.

FRAME CONSTRUCTION TIG welded Aluminum space frame with tubular steel roll bars

MATERIAL AL7020 33x3mm tubes

OVERALL L / W / H (mm) 2750 / 1430 / 1145

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 141 / 151

SUSPENSION Double unequal length A-Arm. Push rod actuated vertically oriented spring and damper

TYRES (Fr / Rr) 205 x 45 R13 Continental R25A

WHEELS (Fr / Rr) 8 x 13, 28 mm offset, 3 pc Al Rim

ENGINE Honda CBR600RR

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.0:1

FUEL SYSTEM Student des/built fuel injection, sequential

FUEL E85 ethanol

MAX POWER DESIGN (rpm) 9000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE 525 DID chain

DIFFERENTIAL Drexler Limited Slip Differential

COOLING Single radiator, mounted on top of the oil-tank, thermostatic controlled electric fans

BRAKE SYSTEM Hub mounted, 248 mm outer diameter, 146 mm inner diameter, dual piston calipers

ELECTRONICS RS485 bus connection between ECUs, multifunctional steering wheel

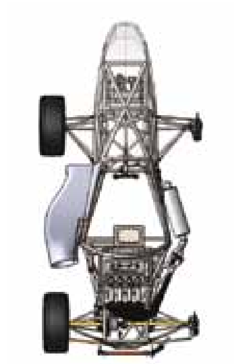
STRALSUND

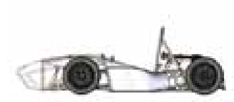
University of Applied Sciences Stralsund

Car 10 Pit 25

Germany

Being the very first German Formula Student Team, the Baltic Racing Team combined all their experience and knowledge of 11 years into their new car: the „TY2011“. Since 1999 we designed and constructed 12 cars end experienced a lot in the field of automotive engineering. Race cars manufactured in Stralsund were known for their robustness and simplicity, but also for their great drivability and speed. Our team consists of students from many different study courses so there is a diversity of ideas and imaginations existing in our everyday work. The overwhelming creativity which is produced in our offices and garages motivates us to put all our energy into this project. Our this year's goal was to build a car with a perfect overall concept. With this concept we want made a great performance at the event in Hockenheim 2011.





FRAME CONSTRUCTION tubular space frame

MATERIAL AISI 4130

OVERALL L / W / H (mm) 2780 / 1410 / 903

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1240 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128 / 139

SUSPENSION Double unequal length, nonparallel A-Arm. Pull rod actuated, longitudinal oriented Springs,"X-Fusion

TYRES (Fr / Rr) Continental FSAE Tires 2011, 205/510 R13

WHEELS (Fr / Rr) 7x13, 12.5 mm offset, modified 3pc Al-Mg

ENGINE 2001 Honda CBR600 F4i PC35

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 600cc

COMPRESSION RATIO 12.9:1

FUEL SYSTEM student designed/built fuel injection system using Walbro ECU

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE Chain #520 MAD6

DIFFERENTIAL torque biasing, Torsen B (Quaife), adjustable preload

COOLING aluminium radiator, at left sidepod, electronic fan integr. in nozzle of sidepod

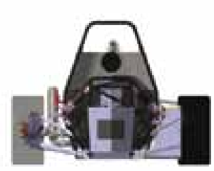
BRAKE SYSTEM 4-Disk system, Floating, hub mounted, wave-design steel brake discs

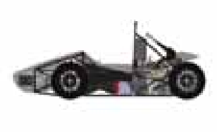
ELECTRONICS E-Shifter with self developed controlunit, 2D-Data-Logger-System, GPS, CAN

STUTTGART
Baden-Württemberg Cooperative State University Stuttgart

Our team consists of students from the Cooperative State University Stuttgart and was founded in 2008. The first challenge on a racetrack was here in Hockenheim in 2009 where we gathered a lot of experience. One year later, we came back to Hockenheim with our second car called „Sleek10" – approximately 60 kg lighter than its older brother „Sleek09". Unfortunately, heavy rain during the endurance-event made it impossible to show the potential of „Sleek10" on a longrun. This year we built a completely new car, saved another 30 kg and now we are looking forward to showing the speed of our new „Sleek11" not only in the statics, but especially on the track to make our motto „Sleek11 – the achievements of the previous years united in one car" come true. „Sleek11" is powered by a Honda CBR600RR 4R-engine with 85 hp at 12,000 rpm and a torque of about 65 Nm at 8,000 rpm. The weight-to-power ratio is now at a great level of 2.7 kg/hp. More details on http://www.dhbw-engineering.de

Car 55 Pit 62 Germany





FRAME CONSTRUCTION One piece tubular steel space frame (TIG welded)

MATERIAL Frame: 25CrMo4, round tubing (22 to 25 mm in diameter); Bodywork: Carbon Fibre and Fabric

OVERALL L / W / H (mm) 2640 / 1460 / 1060

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1250 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 149 / 149

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper (coil-over).

TYRES (Fr / Rr) 178 x 50 R13, Hoosier R25B

WHEELS (Fr / Rr) 7 x 13, 22mm offset, 1pc Al Rim

ENGINE Modified Honda CBR600RR (PC37)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,0:1

FUEL SYSTEM Electric fuel pump with single injector for each cylinder and common rail injection fuel

FUEL 98 octan unleaded gasoline

MAX POWER DESIGN (rpm) 12000

MAX TORQUE DESIGN (rpm) 8000

DRIVE TYPE gearbox with chain drive

DIFFERENTIAL Drexler limited slip differential with internal preload adjustment

COOLING Single side pod mounted radiator with thermostatic controlled electric 254mm fan and water pump

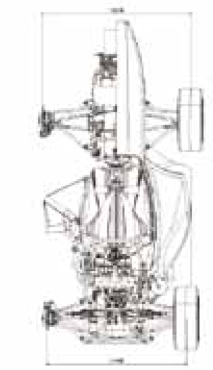
BRAKE SYSTEM 4-Disk system with 240mm (Fr) / 220mm (Rr) diameter and floating mounting, adjustable brake balance

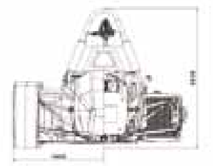
ELECTRONICS Selfdesigned power and control electronics, Electropneumatic Shifting System

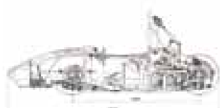
STUTTGART
University of Stuttgart

Since the foundation in 2005 one of the most important reasons for success of Rennteam Uni Stuttgart was to set clear goals right from the beginning of development of every new car. By having the focus on completing the car as fast as possible the aims of finishing the endurance and winning the competition complete the three major goals in development of the F0711-6. The long period of intensive car testing ensures a reliable and powerful racecar. In order to reduce both, weight and fuel consumption, several new concepts have been implemented. The CFRP Monocoque with a tubular space frame rear was chosen to improve accessibility and maintenance of the entire power train. Every detail of the suspension system was redesigned resulting in further weight reduction. With the F0711-6 the Rennteam has once more managed to build a competitive car. Looking forward to meeting the international competition, the team is excited for the Formula Student Germany Event 2011.

Car 29 Pit 31 Germany







FRAME CONSTRUCTION CFRP monocoque with tubular steel spaceframe rear

MATERIAL carbon fibre prepregs and aluminum hoeycomb sandwich panel, 25CrMo4 steel tubes

OVERALL L / W / H (mm) 2678 / 1405 / 1070

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1610 / 1210 / 1140

WEIGHT WITH 68kg DRIVER (Fr / Rr) 123 / 134

SUSPENSION unequal length, double wishbones, pullrod front and pushrod rear actuated ZF Sachs dampers

TYRES (Fr / Rr) 20x7 R13 / 20x7.5 R13

WHEELS (Fr / Rr) OZ FSAE Superleggera 13x7 (front and rear)

ENGINE modified Honda CBR600RR (PC37)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13,5:1

FUEL SYSTEM student built fuel injection system using MoTec, fully sequential

FUEL E85

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 7500

DRIVE TYPE Chain #520

DIFFERENTIAL Drexler limited slip differential TBR adjustable in drive and caster

COOLING custom made single radiator, mounted in left sidepod, thermostatic controlled fan

BRAKE SYSTEM self made 4 disc system using radial mounted ISR calipers, driver adjustable brake balance

ELECTRONICS self made wiring harness, multifunctional steering wheel, live telemetry system, using CAN bus

TALLINN

Tallinn TU - University of Applied Sciences

Car 18 Pit 55

Estonia

FS Team Tallinn comes from Estonia and is one of very few eastern European teams competing in the worldwide FSAE competitions. We first came together in December 2006 and since then have competed in all main competitions in Europe and United States. In our first ever competition in Silverstone 2008 we won the Best Newcomer trophy. In 2010 it was followed by 7th overall. In the past two years we have twice won the Baltic Open competition and therefore established ourselves as one of the best teams in Northern Europe. This year we are building our third, most advanced car yet - the FEST11. Our latest prototype combines all of our earlier experience. We have focused on not only saving weigh but also maximizing the power output and dynamics of the car. All components are analyzed through different computer aided simulations, manufacturing is done to the highest standard - nothing is being left out of attention. This year we have taken our customization to a completely new level.

FRAME CONSTRUCTION Front and rear tubular space frame

MATERIAL 25CrMo4 steel round tubing 16mm to 30mm diam.

OVERALL L / W / H (mm) 2684 / 1417 / 995

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1540 / 1200 / 1167

WEIGHT WITH 68kg DRIVER (Fr / Rr) 119 / 146

SUSPENSION Double unequal lenght A-arms. Push rod actuated Penske 7800 dampers with coil springs.

TYRES (Fr / Rr) Hoosier R25B 18.0 x 7.5-10

WHEELS (Fr / Rr) 7,5x 10" 1 mm offset, 3 pc Al Rim

ENGINE 2010 Yamaha YZF-R6 4 cylinder

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.8:1

FUEL SYSTEM Student designed and built, fuel injection, sequential, variable fuel pressure

FUEL 98

MAX POWER DESIGN (rpm)

MAX TORQUE DESIGN (rpm)

DRIVE TYPE

DIFFERENTIAL

COOLING One side pod mounted radiator w/ oil to water heat exchanger, ECU controlled fan

BRAKE SYSTEM 4 disk system, floating self made rotors 195mm diam., adjustable brake balance,

ELECTRONICS Student built LiFePo4 batteries, self made steering wheel with shifting paddles, suspension position

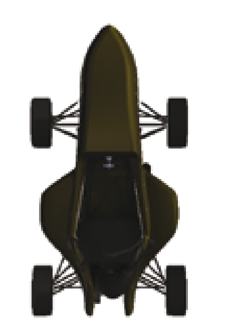
TAMPERE

University of Applied Sciences Tampere

Car 79 Pit 17

Finland

This year we are proud to present our newest racecar FS011 which is our 4th Formula Student -class racing car. Compared to our previous car, significant changes have been made to truly challenge other teams in Europe. Over 30 students have worked with this project in development, material testing and various other manufacturing tasks. With the help of our sponsors we have been able to build a car with some of the finest components out there, resulting in a package high on quality and performance. The combination of great technical solutions with a practical and cool appearance, make this car worth looking for.



FRAME CONSTRUCTION Tubular space frame

MATERIAL Ruukki Form 500 high strength steel

OVERALL L / W / H (mm) 2510 / 1520 / 1150

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1560 / 1260 / 1240

WEIGHT WITH 68kg DRIVER (Fr / Rr) 110 / 130

SUSPENSION Double unequal length A-Arm. Pull rod actuated spring and damper

TYRES (Fr / Rr) Hoosier R25B 20,5x7 R13 / Hoosier R25B 20,5x7 R13

WHEELS (Fr / Rr) Keizer 7x13 31 mm offset, 3 pc Keizer CL-1 Al Rim

ENGINE Yamaha YFZ450R

BORE / STROKE / CYLINDERS / DISPLACEMENT 97mm / 60mm / 1 cylinders / 443cc

COMPRESSION RATIO 13,0:1

FUEL SYSTEM Tatech T32 engine management system with sequential fuel injection and direct fire

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 8000

MAX TORQUE DESIGN (rpm) 5000

DRIVE TYPE 520 Chain

DIFFERENTIAL Drexler FSAE Limited Slip Differential, STM slipper clutch

COOLING Cooling radiator mounted in sidepod, electric waterpump, electric fan

BRAKE SYSTEM 4-disc system, floating rotors with 240/220mm diameter, AP Racing calipers and main cylinders

ELECTRONICS Electropneumatic Shifting System, Multifunctional Steering Wheel, Data Acquisition, Telemetry

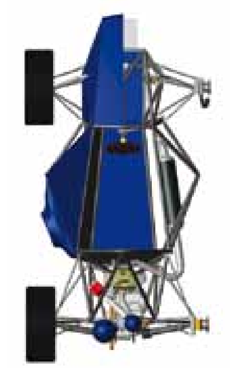
TORONTO

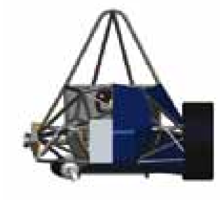
University of Toronto

Car 12 Pit 44

Canada

UT11 marks the 13th vehicle produced by the University of Toronto since its inception in 1997. The knowledge and experience developed over the past 14 years has culminated in the design and manufacture of our 2011 vehicle. FSG2011 will mark the 4th appearance for Toronto at this event and are eager to fight for the championship.Strong focus was placed on developing the driver during the 2011 season. A STACK data acquisition unit was employed to log engine/vehicle parameters and analysis on specific driving styles were conducted. To reduce stress on the driver an electronic brake distribution controller was implemented to provide varying brake bias during trail braking vs. full braking applications. UT11 is the third season running the Honda TRX450R motor with focus on fuel efficiency and drivability. Engine compression has been raised from 12:1 to 13.5:1 and a stepped diameter exhaust header has been implemented to broaden the torque curve for a more usable power band.





FRAME CONSTRUCTION Steel Tube Spaceframe

MATERIAL 4130 ChroMoly Steel

OVERALL L / W / H (mm) 2459 / 1422 / 1186

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1676 / 1193 / 1168

WEIGHT WITH 68kg DRIVER (Fr / Rr) 108 / 132

SUSPENSION Double unequal length a-arm, pushrod actuated Cane Creek Double Barrel

TYRES (Fr / Rr) 20.5x7-13 R25B Hoosier

WHEELS (Fr / Rr) Braid Formrace, 6.0x13 19mm offset, 2pcs Al

ENGINE Honda TRX450R

BORE / STROKE / CYLINDERS / DISPLACEMENT 96mm / 62mm / 1 cylinders / 449cc

COMPRESSION RATIO 13.5:1

FUEL SYSTEM Haltech PS1000 with sequential injection

FUEL 93 Octane

MAX POWER DESIGN (rpm) 8000

MAX TORQUE DESIGN (rpm) 6500

DRIVE TYPE 520 Chain drive

DIFFERENTIAL Student designed Salisbury type differential with external TBR adjustment

COOLING Single side-mounted radiator sealed to duct, thermostatically controlled fan

BRAKE SYSTEM 4-Disc system, 228mm diameter 44W steel rotors, electronic brake distribution contol

ELECTRONICS STACK MFR 30-Channel DAQ with CAN integration to ECU

TURIN

Polytechnic University of Turin

Car 46 Pit 48

Italy

When taking shape in 2005, the SquadraCorse was 10 people team of pasionates, during the 6 years of activity, the team transformed into a professionally managed group of 50 persons representing six different countires. Divided, in four divisions: Frame, Engine, Control and Organization & Marketing, SquadraCorse is bringng to You the latest, prototype designed and build in Turin, the SCX^2. SCX^2 presents the tubular space frame lay-out with modified Honda CBR 600 RR engine. One of the major changes is lack of the rear BOX which was a mark of all SC cars. The main goal that we wanted to achieve, was the overall weight reduction(205kg instead 220kg), in order to be again competitive with the best Formula Student Teams. After amazing 2010 season (10th overall in FS UK, 6th overall FSG) when the team was placed on the 5th position among the european teams, the SquadraCorse wants to show again the italian team spirit. See You all at the HockenheimRing!!!

FRAME CONSTRUCTION Tubular Space Frame

MATERIAL 4130 Steel Round Tubing OD 25.4, Thickness from 0,89 to 2,4

OVERALL L / W / H (mm) 2745 / 1402 / 1058

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1620 / 1210 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128 / 145

SUSPENSION Double unequal A-Arm, Push rod actuated horizontally, oriented spring and damper

TYRES (Fr / Rr) 20,5x7 R13 Hoosier

WHEELS (Fr / Rr) Custom made Magnesium rims 7x13

ENGINE Modified 2005 Honda CBR 600 RR

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13

FUEL SYSTEM Student built fuel injection sequential

FUEL 98/E85

MAX POWER DESIGN (rpm) 13000

MAX TORQUE DESIGN (rpm) 10000

DRIVE TYPE 415/520 Chain Drive

DIFFERENTIAL Clutch pack LSD

COOLING Left side mounted Water/Oil Radiator with 2 electric fans

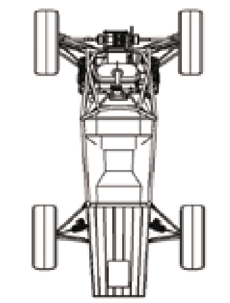
BRAKE SYSTEM 4 Disk, floating, stainless steel heat treated, hub mounted 218mm diameter

ELECTRONICS Traction Control, Launch Control, Automatic and Sequential shift, Real Time Telemetry

UXBRIDGE
Brunel University

Car 43 Pit 2

United Kingdom



FRAME CONSTRUCTION Front aluminium honeycomb monocoque / Rear steel tubular spaceframe hybrid

MATERIAL

OVERALL L / W / H (mm) 2573 / 1377 / 977

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1580 / 1200 / 1275

WEIGHT WITH 68kg DRIVER (Fr / Rr) 130 / 146

SUSPENSION Double unequal length A-Arm. Pull rod actuated vertically orientated spring damper

TYRES (Fr / Rr) Hoosier 7.0/20.5 R13 R25B

WHEELS (Fr / Rr) Hoosier 7.0/20.5 R13 R25B

ENGINE 2007 Yamaha YZF-R6

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.6:1

FUEL SYSTEM Multi point fuel injection 3.5bar/160cc injectors/Intergrated FDM

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12500

MAX TORQUE DESIGN (rpm) 8500

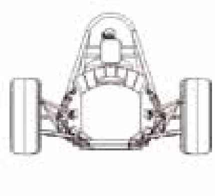
DRIVE TYPE Single 520-pitch Chain

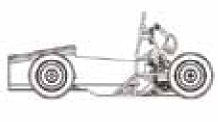
DIFFERENTIAL Drexler 2010 Clutch Type LSD

COOLING Sidepod mounted double pass radiator with ECU controlled electrical pump

BRAKE SYSTEM AP Racing 4-Pot Front/2-Pot Rear Calipers / 220mm Custom iron discs

ELECTRONICS



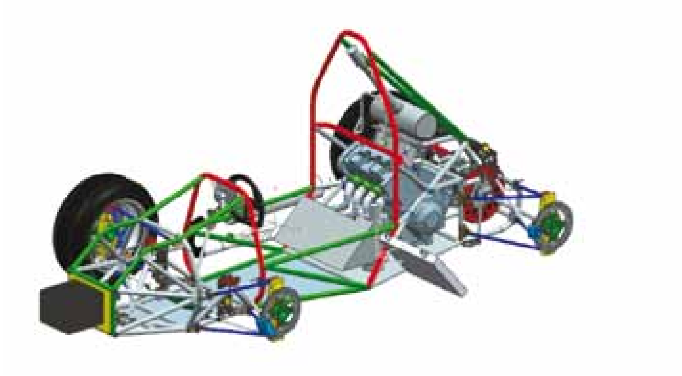


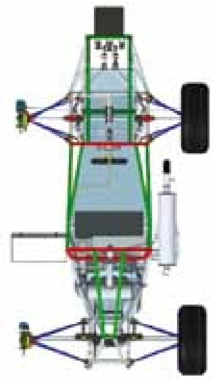
An integral part of Brunel University's Motorsport and Mechanical Engineering degree courses; Brunel Racing has competed in the UK Formula Student event for the past 11 years, with a top finish of 6th in the UK event in 2009. BR12 is the third iteration of the hybrid aluminium honeycomb monocoque/rear spaceframe chassis, providing a low cost and stiff structure. Brunel Racing is hoping achieve its highest result to date by focusing on reliability and minimising weight. This has also involved covering substantial distance during testing to ensure a robust vehicle is brought to competition. For more information about Brunel Racing please contact us on our website: www.brunelracing.co.uk or visit us in our pit garage.

VITERBO
Tuscia University

Car 60 Pit 9

Italy





FRAME CONSTRUCTION Steel tubolar space frame with carbon fiber panels

MATERIAL Steel tubes and Epoxy resin with 380 gr/m2 carbon fiber panels

OVERALL L / W / H (mm) 2450 / 1350 / 1160

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1240 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 143 / 162

SUSPENSION Double unequal length A-Arm. Push rod actuated spring and damper. Adjustable in compres./rebound.

TYRES (Fr / Rr) 20x7.2-13 A45 Soft Avon

WHEELS (Fr / Rr) 13" X 7 „ 108 PCD, +31 ET, Braid FormRace

ENGINE Modified Honda CBR F Sport year 2002

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.1

FUEL SYSTEM GET HPUH-4 ECU Renesas SH2 microcontroller 32 Bit RISC 80 MHz 100,with sequential injection

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 12500

MAX TORQUE DESIGN (rpm) 10500

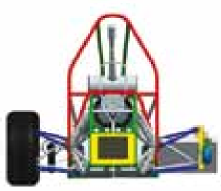
DRIVE TYPE 11/52 drive-driven sprockets

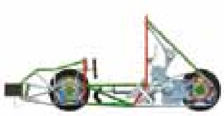
DIFFERENTIAL Drexler Limited Slip Differential V1

COOLING Lateral mounted 1000cc Honda radiator with 220mm electric fan

BRAKE SYSTEM 4-Disk system, self developed rotors with 230mm diameter, proportioning valve, AP racing calipers

ELECTRONICS wiring harness sealed to IP67, electronic dashboard with datalogging, exaust gas thermocouples, GPS





The philosophy behind the 2011 project involves the design and implementation of a reliable car, powerful, easy to ride and with low cost of implementation and ownership. In developing the project an extensive use of CAE software has made, for mechanical design and for the design and tuning of the powertrain.The 2010 car had shown a high reliability, going to points in all tests of endurance, and a powerful and tuned powertrain. The main defects of the car 2010 were still high weight and not optimal handling.The cornerstones of the 2011 project then are to reduce weight, optimize handling and the adoption of anti-roll bars, not in the vehicle 2010. For the powertrain developments have focused on getting a power increase of about 5 HP earned by working on cam timing and reducing consumption, optimizing the fuel mixture in relation with the temperature of the exhaust gases.

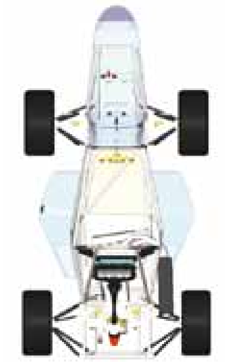
WEINGARTEN

University of Applied Sciences Ravensburg-Weingarten

Car 66 Pit 3

Germany

The Formula Student Team Weingarten is the racing team of UAS Ravensburg-Weingarten, established in 2008. During the current season we can rely on more than 30 students and a considerable number of sponsors. Together it was possible to build our third racing car the „Stinger 11", to take part in our 2nd Formula Student event at Hockenheim. To improve the results from last year, we set our focus on a better communication inside the team to avoid mistakes in an early stage. This was achieved by weekly workshops and a comprehensive knowledge database. Thereby we were able to keep our timetable tight and have more time for testing and instructing our drivers. Our technical aims were mainly to improve the cars kinematic capabilities as well as gaining an increase in torque and engine performance and losing weight. With great enthusiasm the Formula Student Team Weingarten is looking forward to the Event in Hockenheim to compete with other teams and have a fantastic time beside the track.



FRAME CONSTRUCTION Stainless steel tubular space frame

MATERIAL 1.4301 (X5CrNi 18-10) stainless steel

OVERALL L / W / H (mm) 2751 / 1469 / 1242

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1560 / 1200 / 1238

WEIGHT WITH 68kg DRIVER (Fr / Rr) 131 / 197

SUSPENSION Double unequal length A-Arm. Push rod actuated spring and damper, hand-made CFRP-wishbones

TYRES (Fr / Rr) 205x70 R13, Hoosier R25B / 205x70 R13, Hoosier R25B

WHEELS (Fr / Rr) 7.0x13, 22mm offset 1pc Al Rim / 7.0x13, 22mm offset 1pc Al Rim

ENGINE Honda CBR 600 RR (PC40)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12,2:1

FUEL SYSTEM Bosch MS4 Sport with sequential fuel injection system

FUEL 98 octane unleaded gasoline

MAX POWER DESIGN (rpm) 11500

MAX TORQUE DESIGN (rpm) 7500

DRIVE TYPE XW-Ring Chain 520

DIFFERENTIAL Drexler Formula Student 2010 V.3 limited slip differential

COOLING Custommade single radiator, mounted on the left side-box with 200mm electric fan

BRAKE SYSTEM 4-Disk system, self developed rotors with 220mm diameter,adjustable brake balance

ELECTRONICS Multifunctional Steering Wheel, Electropneumatic automatic Shifting System

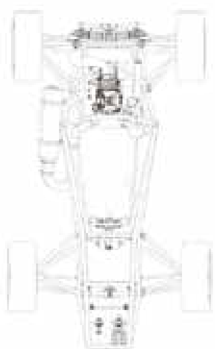
WIEN

Technical University of Wien

Car 41 Pit 39

Austria

The growling monster is back! Founded in 2007, TUW Racing is known for its excellence in race car constructrion. After two years of development the youngest member of the edge breed is ready for competition, the edge mk3. It features the latest incarnation of the legendary carbon fiber tube frame, the roaring supercharged KTM single-cylinder engine and the superlight flex-blade-based suspension. New kinds of carbon fiber based materials are used to reduce the weight of the bodywork and the exhaust system to the minimum. Development focussed on continuos evolution of proven designs and bringing weight down but keeping or improving performance. The highlights are: Bodywork out of spread-weaving CFRP, Exhaust manifold out of carbon-ceramic material and 5 spoke CFRP Rims. Be aware, it's edge mk3.



FRAME CONSTRUCTION CFRP Tubular Frame with steel roll bars

MATERIAL UHM CFRP

OVERALL L / W / H (mm) 2680 / 1430 / 1000

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1640 / 1200 / 1160

WEIGHT WITH 68kg DRIVER (Fr / Rr) 121 / 122

SUSPENSION Double unequal length A-Arm, pull-rod actuated FSAE Cane Creek/Öhlins dampers

TYRES (Fr / Rr) 205/510 R13 Continental Formula Student 2011

WHEELS (Fr / Rr) 7x13 CFRP

ENGINE KTM LC4 supercharged with Rotrex charger

BORE / STROKE / CYLINDERS / DISPLACEMENT 102mm / 74.6mm / 1 cylinders / 609cc

COMPRESSION RATIO 9,5:1

FUEL SYSTEM Bosch MS4 controlled sequential fuel injection and ignition

FUEL E85

MAX POWER DESIGN (rpm) 8800

MAX TORQUE DESIGN (rpm) 7000

DRIVE TYPE Sequential gear box with 4 gears

DIFFERENTIAL Drexler Formula Student LSD with modified housing

COOLING Radiator mounted in sidepod

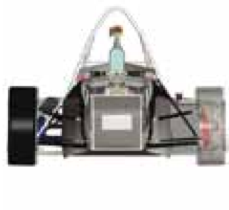
BRAKE SYSTEM 4-Disk system, self developed rotors, adjustable brake balance, AP-Racing calipers

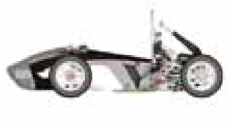
ELECTRONICS Multifunctional steering wheel, Electropneumatic Shifting System, CAN-based data logging

WOLFENBÜTTEL
University of Applied Sciences Ostfalia

Car 35 Pit 64 Germany

In 2011 the Team wob-racing joints the FSG Evet with the WR07. The Car is developed as part of a platform strategy which means, the WR07 and the WR07-E from eTeam wob-racing go together in the basic design. The WR07 is powered by a Honda PC40 engine. To ensure a good maintenance and a high accuracy for suspension and the drivetrain we are using a highly development rear module that is fastened on the engine. We evolved the dry sump from the WR06 to benefit from a constant oil pressure during high lateral acceleration. The dashboard is the centre of information and control unit for the driver. It supports with information like gear, rpm and warning lamps and integrates the control unit for the dashboard. Also car functions like traction-control, launch-control and emergency stop can be controlled by the driver. Another special feature is the possibility to dim the LED´s. The WR07 is a powerful race car and we hope to improve the last years´results in Hockenheim with this car.





FRAME CONSTRUCTION front and rear tubular space frame with a bolted rear module

MATERIAL E355 steel round tubing 10-26mm dia, 1-1.6mm wall thickness; rear module made of EN AW-6082

OVERALL L / W / H (mm) 2636 / 1465 / 1056

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1270 / 1240

WEIGHT WITH 68kg DRIVER (Fr / Rr) 146 / 147

SUSPENSION double unequal A-arm. Pushrod actuated, horizontally oriented damper (fr). Adj. jounce and rebound

TYRES (Fr / Rr) Hoosier 20.5x7.0-13 R25B / Hoosier 20.5x7.0-13 R25B

WHEELS (Fr / Rr) self designed 1pc. Al rim 7.0x13, 0mm offset/self designed 1pc. Al rim 7.0x13, 0mm offset

ENGINE Modified Honda CBR600RR (PC40) with dry sump

BORE / STROKE / CYLINDERS / DISPLACEMENT 67.0mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 12.5:1

FUEL SYSTEM self designed rail, MPI, twin spray, injector location 140mm before and pointing toward intakevalve

FUEL 98 octane unleaded

MAX POWER DESIGN (rpm) 11000

MAX TORQUE DESIGN (rpm) 8500

DRIVE TYPE chain drive

DIFFERENTIAL clutch type limited slip differential from Drexler with adjustable lock values

COOLING one left side mounted radiator, electrical fan and water pump

BRAKE SYSTEM 4disc system, seld designed rotors dia. 230mm (front), dia. 200mm (rear), adjustable balance bar

ELECTRONICS harness sealed to IP67, electropneumatic shiftingsystem, Highspeed CAN2.0B 1Mbit/s, elec. fuse box

WROCŁAW
Technical University of Wrocław

Car 24 Pit 78 Poland

PWR Racing Team is proud to present RT02 - the second car build by the team. Boosted by the great reception of our first car RT01, high goals were set for the new build. With the help of advanced managerial tools we could divide the tasks between the right persons and increase the performance of the whole team. One of the most interesting features of the new car is the frame - which is a two-piece - which increases the ease of servicing and fine tuning. A lot of effort was put into engine performance. Thanks to the switch to E85 a higher compression pistons could be fitted. This together with high performance exhaust and variable length intake manifold results in a powerful engine. RT02 was also our first car where carbon fibre was introduced on such high scale. Wishbones, driveaxles aje just the few main things which were produced out of this material. We would like to than out University, our Sponsors and everyone who helped during the build of this car. Hockenheim - we are coming!

FRAME CONSTRUCTION Steel tube space frame

MATERIAL AISI 4130

OVERALL L / W / H (mm) 2729 / 1428 / 1209

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1550 / 1250 / 1170

WEIGHT WITH 68kg DRIVER (Fr / Rr) 139 / 169

SUSPENSION Double unequal length A-Arm. Pull rod / Pull rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) Avon A45 20.0x7.2x13 / 20.0x7.2x13

WHEELS (Fr / Rr) 13x7.0/13x7.0, 2pc aluminium, Braid Formrace 16

ENGINE Modified Honda CBR600RR, PC40

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42.5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13,5:1

FUEL SYSTEM Student designed/built fuel injection system using MoTeC ECU

FUEL E85

MAX POWER DESIGN (rpm) 10500

MAX TORQUE DESIGN (rpm) 7000

DRIVE TYPE stock Honda gearbox

DIFFERENTIAL Drexler Limited Slip Differential FS.2010.V3

COOLING Two custom ratiators, one radiator

BRAKE SYSTEM 4-Disk system, 210mm diameter, adjustable brake balance, ISR 4-piston (Fr) and 2-piston (Rr) caliper

ELECTRONICS wiring harness, Electropneumatic Shifting System, selfdesigned Live-Telemetry System

AACHEN
RWTH Aachen University

Car E42 Pit E7

Germany

Founded in 2009 as a branch to one of the oldest teams in the history of Formula Student in Europe, Ecurie Aix electric is competing at FSE in 2011 after proudly presenting a functioning car in 2010. Once again the team has built two cars for both the electric and combustion competitions in 2011.The changes from the eace01 (Ecurie Aix Car Electric no.1) to the eace02 are mainly within the drivetrain. A lot more (intelligent) power and torque, as well as a innovative bevel gear transmission are the key features when comparing with the growing competition. Still, safety and maintainability are ensured by the use of the successfully proven hybrid design, where the car combines a carbon fibre monocoque with a tubular space frame.

FRAME CONSTRUCTION Hybrid design, front: monocoque, rear: tubular space frame

MATERIAL Monocoque: reinforced carbon fibre, rearframe: steeltubing 15CDV6

OVERALL L / W / H (mm) 2802 / 1534 / 1264

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1250 / 1176

WEIGHT WITH 68kg DRIVER (Fr / Rr) 140 / 260

SUSPENSION Front: Multilink Suspension. Push rod actuated horizontally oriented monoshock and rollspring

TYRES (Fr / Rr) 205/510 R13 by Continental

WHEELS (Fr / Rr) 7.5x13 -20mm offset, 3 pc Al Rim by BBS

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear left, Rear right / 92kW

MOTOR TYPE AMK DP7-60-10-POW

MAX MOTOR RPM 7172

MOTOR CONTROLLER AMK KW60

MAX SYSTEM VOLTAGE 600V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo / 7kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:5,27 /

DRIVE TYPE Bevel gearing

DIFFERENTIAL Electronic differential (Torque Vectoring)

COOLING Water cooling

BRAKE SYSTEM 4-Disk system, 240mm rotor diameter, adjustable brake balance (front/rear)

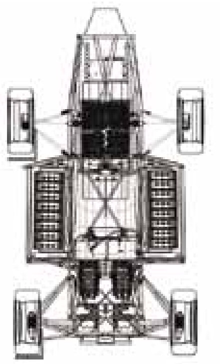
ELECTRONICS Self-developed: multifunctional steering wheel, BMS, traction control, data logging

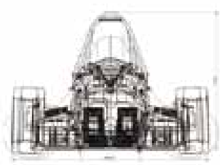
BAYREUTH
University of Bayreuth

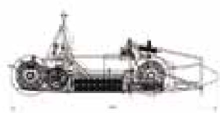
Car E11 Pit E9

Germany

In spring 2004 a small group of engineering students at University of Bayreuth's then youngest faculty founded Elefant Racing. The name is derived from the Faculty of Applied Sciences' abreviation FAN which shares its letter string with the clever and powerful animal.Starting into season 2010/11 we decided to brake with our tradition of building monocoque combustion cars. With the FR11 Cocoon we developed a high performance lightweight racing car completely electric powered. Based on the special characteristics of electric engines – especially a thrilling high torque through the whole rpm range - the FR11 offers an absolute new racing experience compared to conventional combustion engines.Up to 30 minutes enthralling racing experience are provided by 950 LiFePO4 accumulator cells with a capacity of 7.2 kWh.







FRAME CONSTRUCTION tubular steel frame

MATERIAL E 355 +N, E 235 + C

OVERALL L / W / H (mm) 2360 / 1212 / 1006

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1550 / 1300 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 160 / 209

SUSPENSION Double unequal length A-Arm. Push rod actuated in plane oriented spring and damper , front and rear

TYRES (Fr / Rr) Hoosier, 205x70 R13 R25B/Hoosier, 205x70 R13 R25B

WHEELS (Fr / Rr) 7x13, 22mm offset,1 pc Al Rim/7x13, 22mm offset,1 pc Al Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 30kW

MOTOR TYPE Perm Motor PMS 156W

MAX MOTOR RPM RR,RL: 6500

MOTOR CONTROLLER Infineon Hybrid Kit II

MAX SYSTEM VOLTAGE 460V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiFePo4 / 7,7kW

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:3.83 / 1:4,54

DRIVE TYPE two chain drives

DIFFERENTIAL electronical differential

COOLING Twin side pod mounted radiators (water with electric pump)

BRAKE SYSTEM 4-Disk System,CroMoV4,200mm;Calipers: 35mm dia., Dual piston, fixed mtg ; adjustable brake balance,

ELECTRONICS traction control, datalogging, dSpace micro auto box,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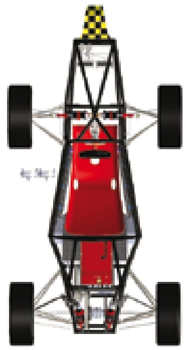
BRATISLAVA

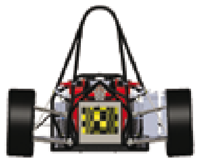
Slovak University of Technology in Bratislava

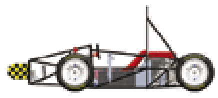
Car E101 Pit E22

Slovakia

Stuba Green Team from Slovak University of Technology in Bratislava was founded in the autumn of 2009 with the idea of developing student's electric race cars. The team has 30 members and consists mainly from students of Mechanical Engineering. Chassis of our second formula race car, the SGT-FE11 is designed on the basis of our first electric race car but further optimized with extensive computer simulations and the weight of chassis was reduced. The suspension is a double wishbone, with unequal length and non parallel arms at front and rear. Dampers and springs are actuated trough pushrods on both axles. According to the experiences that we gained during last year's season we have redesigned the whole powertrain concept. Electric propulsion system of our race car consists of one AC electric motor, double chain drive, limited slip differential and LiPol batteries. Electric system is maintained with our self-made battery management system and the central vehicle control unit.







FRAME CONSTRUCTION Tubular steel space frame

MATERIAL Frame welded from 3 types of steel tubes with different thickness

OVERALL L / W / H (mm) 2680 / 1400 / 1140

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1580 / 1200 / 1175

WEIGHT WITH 68kg DRIVER (Fr / Rr) 210 / 218

SUSPENSION Double wishbone with non-parallel unequal length A-Arm. Push rod actuated spring and damper unit.

TYRES (Fr / Rr) 205x44 R13 Continental / 205x44 R13 Continental

WHEELS (Fr / Rr) 7.0x13 Braid, 18 mm offest, 2pc Aluminium

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 1 / Rear Middle / 108 kW

MOTOR TYPE Brusa - Hybrid Synchronous Motor HSM1-6.17.12

MAX MOTOR RPM 11000

MOTOR CONTROLLER Brusa DMC 524

MAX SYSTEM VOLTAGE 436V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPol - ZnCu / 7,2kW

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:6 /

DRIVE TYPE Double chain Drive

DIFFERENTIAL Clutch pack limited slip

COOLING Water cooling, side mounted radiators and fan

BRAKE SYSTEM 4-Disk system, stainless steel laser cut rotors with 220 mm diam, adjustable brake balance AP RACING

ELECTRONICS self designed Battery Management System and Main Control Unit

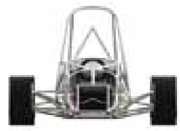
CLAUSTHAL

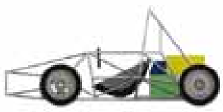
Technical University of Clausthal

Car E23 Pit E14

Germany

In 2011 the Technical University of Clausthal will send their first team to the international competition at the Hockenheimring. Students from different study paths build up a new team, the Green Voltage Racing e.V. It is divided into different working groups to split up works and allow our members to concentrate on their favorite occupation fields. Our main target is to produce a reliable and affordable race-car which is able to compete with cars from all over the world. With its two permanent excitated watercooled synchronous machines and anti-squat/anti-dive chassis our car permits higher performances on course. Special features like our recent patterned heat control system to monitor the heat level within the accumulator stacks complete our portfolio. We thank all our partners and supporters for great 2 years of development and wish all teams a good time at Hockenheim. Follow our latest progress on www.greenvoltageracing.de.





FRAME CONSTRUCTION tubular space frame

MATERIAL 1.0037 steel round tubing, 25mm diameter

OVERALL L / W / H (mm) 3202 / 1649 / 1173

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1400 / 1350

WEIGHT WITH 68kg DRIVER (Fr / Rr) 125 / 233

SUSPENSION double unequal length A-Arm Push rod actuated vertically oriented spring and damper

TYRES (Fr / Rr) 8.5x13, 24mm offset 1 pc aluminum rim, Pirelli

WHEELS (Fr / Rr) 8.5x13, 24mm offset 1 pc aluminum rim, Pirelli

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 69 kW

MOTOR TYPE PERM PMS 146

MAX MOTOR RPM 6000

MOTOR CONTROLLER KEB Combivert F5 Multi

MAX SYSTEM VOLTAGE 504V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY Li-Ion / 14,23kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1 : 2,2 / 1 : 2,2

DRIVE TYPE 2 Stage Chain Drive Type

DIFFERENTIAL -

COOLING Single radiator mounted behind motor compartement, 2 electric fans

BRAKE SYSTEM 4-Disk system, rotor diameter 220mm, adjustable brake balance

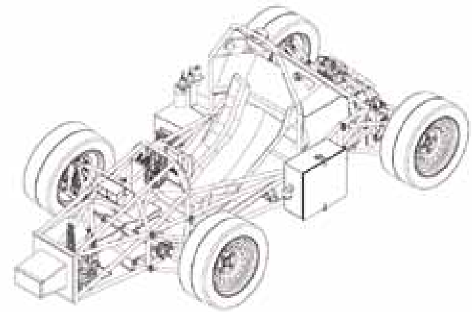
ELECTRONICS wiring harness sealed to IP 67, fibre optical accumulator temperature surveillance,

DEGGENDORF

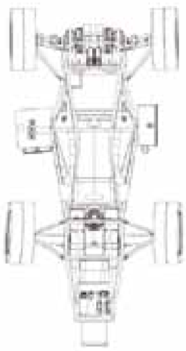
University of Applied Sciences Deggendorf

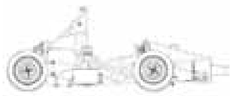
Car E14 Pit E8

Germany



Fast Forest represents the UAS Deggendorf in formula student events. Founded in June 2008 our third season team consists of 40 active team members from every faculty of our university.As well as last year we build two cars. The combustion car FF03 a optimized version of the FF02 and the FF03e the further development of the FF02e.Especially the electric car has a lot of improvements.At first we reduced the cells from 28 to 23 LiPo flat cells to save weight. They are connected in series so the voltage of the accumulator is 85V nominal.In addition the drivetrain was changed completely. The 30 kW permanent magnet motors are now no longer mechanical coupled. Instead they are controlled by an electrical differential.Moreover we want to thank our sponsors for the great cooperation.You'll find further information, pictures and videos from the team and our cars on www.fastforest.de!





FRAME CONSTRUCTION steel tubular space frame with rigid floor and alu guss set on main hoop

MATERIAL e235+c and 4130 steel tubing

OVERALL L / W / H (mm) 2901 / 1459 / 1073

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1610 / 1236 / 1215

WEIGHT WITH 68kg DRIVER (Fr / Rr) 165 / 170

SUSPENSION Double unequal length A-Arm. Pull rod actuated horizontally oriented spring and damper.

TYRES (Fr / Rr) Continental C11 205/510 R13 radial tyre / 205/510 R 13, radial tyre

WHEELS (Fr / Rr) Braid Formrace 16, 13x7J ET 18 two pice / Braid Formrace 16, 13x7J ET 18 two pice

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Left and Rear Right / 30kW, 30kW

MOTOR TYPE Agni 95-R DC-Motors

MAX MOTOR RPM 6000

MOTOR CONTROLLER Kelly KDH 12601E

MAX SYSTEM VOLTAGE 97V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo / 8.51kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:7 / n/a

DRIVE TYPE planetary drive, student designed

DIFFERENTIAL virtual electronic diff with torque vectoring, yaw rate sensetive

COOLING Twin side pod mounted radiators with thermostatic controlled electric fans

BRAKE SYSTEM Magura cylinders, student designed disks, floating, hub mounted, 240mm diameter

ELECTRONICS torque vectoring, CAN-Bus Data logging, selfdesigned Live-Telemetry System

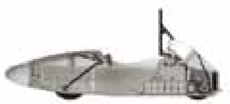
DELFT

Technical University of Delft

Car E85 Pit E1

Netherlands

After ten successful combustion years, the DUT Racing Team will this year focus on a fully electric Formula Student car. This first electric car has a focus on the end-user, the amateur weekend racer. The design focuses on the needs, demands and limitations of this driver. As such, the car is easy to drive due to a good feel of the throttle, brakes and tires. Also the ergonomics and safety is taken in to account, the car is spacious and al the set-ups are easy to adjust. The beating heart of the car is formed by two electric motors and controllers from AMK Antriebe. These are fed by lithium ion polymer batteries which are placed behind the driver. With a peak power of 55 kW, a total energy of 5.7kWh and a weight of only 180 kilograms the team will show their vision on electric cars. Being a team of over fifty technical students from the TU Delft, the team strives to be one of the top teams in the Class 1A competition in England with their electric car: the DUT11.



FRAME CONSTRUCTION Full composite monocoque with aluminium front hoop and steel main hoop

MATERIAL Vacuum infused carbon and Aramid fibre facing, Axson 5015 epoxy, Corecell M60 core

OVERALL L / W / H (mm) 2628 / 1407 / 1064

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1540 / 1200 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 102 / 146

SUSPENSION Unequal length A-Arms. Pull rod actuated Cane Creek Double Barrel spring/damper units

TYRES (Fr / Rr) 180x60 - 10 inch LCO Hoosier

WHEELS (Fr / Rr) Student designed 10

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 27 kW per motor

MOTOR TYPE RR, RL: AMK antriebe DT5-30-10

MAX MOTOR RPM RR,RL: 10500 RPM

MOTOR CONTROLLER AMK Antriebe KW-40

MAX SYSTEM VOLTAGE 400V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY Lithium Polymere / 5,7

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:7,24 / N/A

DRIVE TYPE Spur gears, one step

DIFFERENTIAL Electronic Differential

COOLING Custom radiator mounted centrally behind driver in motor compartment cover

BRAKE SYSTEM 4-Disk system, full-floating rotors with 191mm diameter, adjustable brake balance, AP 4226 calipers

ELECTRONICS wiring harness sealed to IP67, multifunctional steering wheel, student designed DAQ system

DIEPHOLZ

University of Applied Sciences Diepholz/Oldenburg/Vechta

Car E66 Pit E16

Germany

Dynamically is how we'll start; with new energy and a new teamname at the FSE-Event. Our Deefholt Dynamics Team (formerly: FHWT Racing Team) consists of 42 students from mechanical, mechatronic, electrical and industrial engineering. It is our goal to build an electric car that weighs less than 300kg and accelerates from 0km/h to 80km/h within 4 seconds. The race car is based on a tubular frame made of 25CrMo4 steel. The wheel carriers are milled aluminium parts and the wishbones are carbon tubes with aluminium fittings. The rear-wheel drive is powered by two DC motors, which activate the drive mechanism with a chain drive system. The race car's energy source consists of 28 LiPo cells, located behind the driver's seat. We are proud of our self-developed battery management system which measures the voltage of every cell, the temperature of every second cell and supplies the driver with information about BMS failures and critical cell conditions.

FRAME CONSTRUCTION tubular space frame

MATERIAL 25CrMo4 (1.7218) and 15CDV6 (1.7734.5)

OVERALL L / W / H (mm) 2670 / 1470 / 1294

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1300 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 147 / 220

SUSPENSION Double unequal length A-Arm. Pull/Push rod actuated vertically/horizontally oriented spring + damper

TYRES (Fr / Rr) 20.5x6.0 R13, Hoosier R25B / 20.5x7.0 R13, Hoosier R25B

WHEELS (Fr / Rr) 6.0x13, 11 mm offset, 3pc AlMg Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 30kW, 30kW

MOTOR TYPE Agni 95-R DC-Motors

MAX MOTOR RPM 6000

MOTOR CONTROLLER Kelly KDH09401A

MAX SYSTEM VOLTAGE 118V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo / 7,78kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:6,72 /

DRIVE TYPE chain-drive with 1/2 x 5/16 chain pitch

DIFFERENTIAL electronic differential

COOLING Aircooled with overheat protection

BRAKE SYSTEM 4-Disk System, self developed rotors with 200mm diameter, adjustable brake balance, Magura calipers

ELECTRONICS selfdesigned BMS & Telemetry System

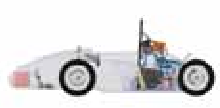
DRESDEN

Technical University of Dresden

Car E44 Pit E6

Germany

Our dream of designing, constructing, and manufacturing a racing car started in 2006, when "Elbflorace" was founded by 18 students full of innovative ideas. After four years of being a part of the FSC, we face a new challenge that has been prepared meticulously: the change to the Formula Student Electric. Months full of fun, effort, passion, persistence, and night shifts lie behind us. Now we are proud to present "Areus", our newest development. The main objective of it was to take the design of the last season's car and change it to the requirements of an electrical powered racing car. All components which have been reused were analysed to reduce weight, improve the performance and reduce costs. The highlight of this year's monocoque chassis is the aluminium back-plate, which ensures an easy maintainability. The car is powered by two strong electric motors and has an advanced low voltage system, keeping track of all different kinds of sensory. Electrifying ELBFLORACE!



FRAME CONSTRUCTION Multi-Parted CFRP Monocoque, assembled via structural bonding

MATERIAL IMS60 & STS40 fibres, epoxy resin, ROHACELL RIST& IG foam, 3D-CORE foam, Wood

OVERALL L / W / H (mm) 2863 / 1436 / 1061

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1200 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 147 / 221

SUSPENSION Double unequal length A-arm. Push rod actuated lateral, horizontally oriented spring and damper

TYRES (Fr / Rr) 205x510 R13, Continental / 205x510 R13, Continental

WHEELS (Fr / Rr) 6.5x13, 35mm offset, 3 pc Al/ Mg Rim / 6.5x13, 35mm offset, 3 pc Al/ Mg Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 35kW, 35kW

MOTOR TYPE Perm Motor PMS 156-W

MAX MOTOR RPM 6000

MOTOR CONTROLLER Semikron SKAI 4001-GD061452W

MAX SYSTEM VOLTAGE 450

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiFePo4 / 7kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:5.15 / n/a

DRIVE TYPE double chain drive,

DIFFERENTIAL n/a

COOLING Left side pot mounted radiators with thermostatic controlled electric fans

BRAKE SYSTEM 4-Disc system (floating), front/rear 240mm/220mm diameter, adjustable brake balance

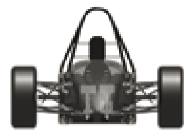
ELECTRONICS Multifunctional dashboar, WLAN Live-Telemetry System, free programmable controllerboard

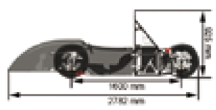
EINDHOVEN
Technical University of Eindhoven

Car E40 Pit E23

Netherlands

The URE06 is the second full electric Formula Student race car from University Racing Eindhoven. University Racing Eindhoven has focused on improving the handling of the URE06. To realize the URE06, the reliable power train from last year's car is used and the monocoque, rear frame and the multilink suspension is completely new. The new monocoque has become lighter and stiffer, as well as the rear frame. To improve the handling even more, a complete new multilink suspension system is developed. The custom designed electronic differential is set up to increase cornering speed by using torque vectoring.





FRAME CONSTRUCTION Carbon fibre monocoque with steel tube space rearframe

MATERIAL SPBac Se84lv/rc200t, Se84lv/UD200HSC monocoque, steel 37 rearframe

OVERALL L / W / H (mm) 2782 / 1392 / 925

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1203 / 1160

WEIGHT WITH 68kg DRIVER (Fr / Rr) 139 / 171

SUSPENSION Full multilink. Pull rod actuated spring and damper (Fr). Push rod actuated spring and damper (Rr)

TYRES (Fr / Rr) 195x40 R15 Vredestein / 195x40 R15 Vredestein

WHEELS (Fr / Rr) 6 inch wide, 3 pc AL/Mg Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 30 kW / motor

MOTOR TYPE Agni 119R

MAX MOTOR RPM 6000 RPM

MOTOR CONTROLLER Kelly Controls L.L.C KDH12121E

MAX SYSTEM VOLTAGE 96V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiMnNiCoO2 / 9.062

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:6.6 / n/a

DRIVE TYPE 2x Chain #428

DIFFERENTIAL Active electronic differential

COOLING 2 Fans, 43.2W each

BRAKE SYSTEM Student designed, laser cut from steel, hub mounted, AP Racing CP5854-94PRTE

ELECTRONICS Motec ADL3, Bluetooth v2.1 Serial Port Profile (SPP)

GRAZ
Technical University of Graz

Car E53 Pit E30

Austria

In an exciting and quite successful first season the TU Graz e-Power Racing Team demonstrated without any doubt that the innovative electric technology is able to compete with traditional petrol-engined racing cars. The biggest challenge in our previous season was the integration of an electric drivetrain into an existing chassis. For the current season we concentrated on a perfect placement of all components in our new chassis, for which we used a complete different production process. All of valuable experiences we gained last year influenced us a lot. Every component was analysed in terms of durability, efficiency and safety. Great value was placed on an advanced motor control to gain more power out of our batteries.Our whole team is looking forward to a new great season. Especially the fact of the increasing number of Formula Student Electric teams promises an exciting Formula Student event.

FRAME CONSTRUCTION Carbon Fibre Monocoque

MATERIAL carbon fibre with additional aramid layers, Conticell C70 structural foam core

OVERALL L / W / H (mm) 2640 / 1430 / 1027

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1580 / 1200 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 153 / 185

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 20,5x7 R13, Hoosier R25B

WHEELS (Fr / Rr) 6.x13, 1 pc Al Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear / 60kw

MOTOR TYPE Prototype Model, IPMSM

MAX MOTOR RPM 12500

MOTOR CONTROLLER Infineon HybridPack 1

MAX SYSTEM VOLTAGE 400V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiCoO2 / 7,15

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:3,2 / n/a

DRIVE TYPE Chain

DIFFERENTIAL Electronic Differential

COOLING Sidepod mounted radiator

BRAKE SYSTEM 4-Disk System, 220mm outer diameter, adjustable brake balance, AP Racing Calipers and Cylinders

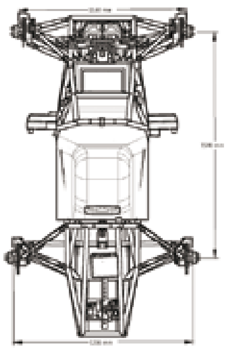
ELECTRONICS wiring harness sealed to IP67, self developed ECU, Active Battery Management System, DC/DC converter

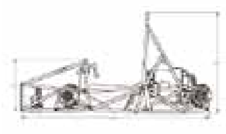
HANNOVER

University of Hannover

Car E26 Pit E25

Germany





The eH11 is the third vehicle from HorsePower Hannover and our first car with pure electric drivetrain. After building two combustion cars we switched to electric because it's a completely new technological challenge. Driven by two permanent magnet excited synchronous machines with 47kW each, combined with torque vectoring technology the car delivers an amazing driving performance. The power is supplied by 420 lithium polymer accumulator cells monitored by a self-developed battery management system. Not only the electric powertrain was built from scratch, also the carbon fiber suspension and magnesium cast uprights are completely new designed. About 30 prospective engineers work meticulously to achieve ideal solutions for the car whereas they are not superficial weather it is day or night. The team is living the spirit of the car - a spirit you can grasp in every single detail. See you in Hockenheim!

FRAME CONSTRUCTION tubular steel space frame

MATERIAL E355

OVERALL L / W / H (mm) 2459 / 1440 / 1188

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1540 / 1200 / 1140

WEIGHT WITH 68kg DRIVER (Fr / Rr) 131 / 218

SUSPENSION double unequal length A-Arm, push rod actuated, upward diagonally oriented spring and damper

TYRES (Fr / Rr) Continental 205/510 R13

WHEELS (Fr / Rr) BBSBBS 7x13, ET 23.3, threepart

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / rear axle / 47kW

MOTOR TYPE AMK DP7-60-10-POW PMSM

MAX MOTOR RPM 1250

MOTOR CONTROLLER AMK KW-60

MAX SYSTEM VOLTAGE 592

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo (LiMnO2) graphite / 7,7kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:5.5 / -

DRIVE TYPE bevel and double helical spur gear

DIFFERENTIAL electrical differential, adjustable torque vectoring

COOLING two symmetrical radiators, electric controlled waterpump, power electronic watercooling solution

BRAKE SYSTEM 4 disk system, self designed rotors 220mm/210mm, adjustable brake balance,

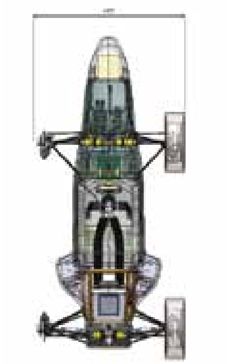
ELECTRONICS CAN 2.0 B, IP67 sealed, wlan telemetry system, self designed dashboard, selfdesigned BMS

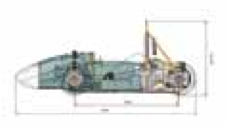
ILMENAU

Technical University of Ilmenau

Car E31 Pit E13

Germany





Team StarCraft e.V. proudly presents our first fully electrically driven formula student car - the TSC-E. About 40 engineering and economics students of Ilmenau University of Technology form our multidisciplinary team. After participating in FSG 2010 with our first combustion car and winning the "Best Newcomer worldwide", we are now meeting new challenges with a new car concept. Besides implementing an electrical drivetrain we realized a light-weight concept. The CFRP monocoque and a tubular steel rear frame offer high weight reduction, provide driver safety and facilitate easy maintenance. Our tractive system consists of two electric motors - actuating the rear wheels individually. Direct drive, high torque motors provide high efficiency and low failure probability. Along with the lithium polymer accumulators they are also main features of the light-weight concept. The required electrical safety is assured by redundant systems. All in all TSC-E is a safe and reliable vehicle.

FRAME CONSTRUCTION front: CFRP-monocoque, rear: steel tube frame, steel tube roll hoops

MATERIAL 224 g/m² carbon non-crimp fabrics, 20 and 10mm alumium honeycomb core, steel tubes made of St 37

OVERALL L / W / H (mm) 2676 / 1407 / 1113

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1545 / 1222 / 1222

WEIGHT WITH 68kg DRIVER (Fr / Rr) 158 / 190

SUSPENSION Double unequal length A-Arm; Push rod actuated, horizontally oriented spring and damper

TYRES (Fr / Rr) 175x55 R13, Dunlop A8D / 175x55 R13, Dunlop A8D moulded

WHEELS (Fr / Rr) 13 x 6, offset 24, 2 pc Aluminium rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / rear left and right / 40kW, 40kW

MOTOR TYPE RL, RR: Parker TKW 130 H

MAX MOTOR RPM 1680

MOTOR CONTROLLER Fräger FMC III-D3-V15, modified

MAX SYSTEM VOLTAGE 588

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo / 6,73

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:1 / 1:1

DRIVE TYPE direct drive

DIFFERENTIAL electronic differential (independently driven rear wheels)

COOLING Twin side pod mounted radiators with temperature controlled electric fans

BRAKE SYSTEM self designed rotors with 210mm OD, adj. brake bias, Brembo calipers, AP-Racing master cylinders

ELECTRONICS self developed main computer, wiring harness sealed to IP 67, multifunctional dashboard

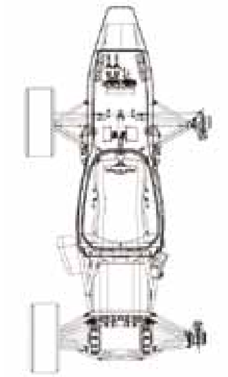
KARLSRUHE

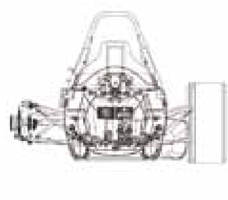
Karlsruhe Institute of Technology

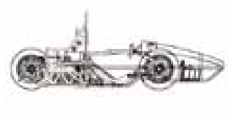
Car E22 Pit E3

Germany

Being a team of about 50 students, KA-RaceIng builds two cars every year: one for the formula student and one for the formula student electric. Starting in autumn with conception and design, we set a very tight production schedule to present our new cars in April. Since then we have tested a lot to get ready to race and train our drivers. The KIT11e is our second electric car and we improved a lot since the forerunner of 2010. With our hybrid chassis consisting of a CRFP monocoque front end and a tubular space frame rear end, we were able to place all components in the center of the car. Two 42 kW motors with 400 V drive the rear axle. The KIT11e has very good power to weight ratio and with its torque vectoring it can show all the performance an electrical car can have. Setting the aim to achieve a top ranking over all we want to show the potential and the great performance of our KIT11e. We would like to thank all supporters and are looking forward to an exciting event at Hockenheim.







FRAME CONSTRUCTION Hybrid Chassis. Front: Carbon fibre Monocoque (VARI) Rear: Steel Space Frame

MATERIAL Front: HT and non-crimp carbon fabric. Rear: Round steel tubing with integral Al-motor-housing

OVERALL L / W / H (mm) 2732 / 1425 / 983

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1630 / 1220 / 1150

WEIGHT WITH 68kg DRIVER (Fr / Rr) 141 / 165

SUSPENSION Double unequal length A-Arms. Pull/Push rod actuated KAZ FSAE damper with coil spring

TYRES (Fr / Rr) Continental 205x45 R13 C11

WHEELS (Fr / Rr) Student made centerlock CFRP rim 7x13

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear left, Rear right / 42kW each

MOTOR TYPE IPMSM, watercooled, designed to spec.

MAX MOTOR RPM 20.000

MOTOR CONTROLLER Vectopower

MAX SYSTEM VOLTAGE 400V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiFePo / 6kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:13,5 / n/a

DRIVE TYPE single stage planetary gear

DIFFERENTIAL No diff. Independently controlled rear wheels.

COOLING Side mounted single radiator

BRAKE SYSTEM Floating steel rotors, outer diameter 230 mm, 4-Piston ISR calipers, Continental ABS

ELECTRONICS Student built controllers (CAN, A/D, 12V Power, Steering Wheel), selfdesigned Live-Telemetry

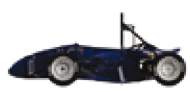
KARLSRUHE

University of Applied Sciences Karlsruhe

Car E13 Pit E28

Germany

E-105 is the first electric car of Highspeed Karlsruhe, the formula student team of the 'University of Applied Sciences, Karlsruhe', designed and developed by 40 enthusiastic students. The E-105 shares its lineage with its combustion counterpart, the F-105, which is in its fifth generation. The blue blooded E-105 with its stunning bodywork remains true to its predecessors. It boasts of an extensive use of electronics to increase safety, practicability and fun. The main focus has been on design and weight optimisation. The new carbon-tube suspension along with a perfect frame and an electric differential makes cornering even more exciting. The torquey motors powered by the Li-ion cells make sure that the party goes on and on. The E-105 marks the beginning of a new chapter in the history of Highspeed Karlsruhe. This has been possible only due to an excellent support from the sponsors, supporters and a highly motivated team. We are looking forward to the exciting event in Hockenheim.



FRAME CONSTRUCTION Tubular space frame

MATERIAL E235+C round tubing with outer diameters of 26 to 30mm

OVERALL L / W / H (mm) 2647 / 1400 / 1077

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1585 / 1208 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 145 / 177

SUSPENSION Double unequal length A-Arm. Push rod actuated spring and damper

TYRES (Fr / Rr) 20.0/7.0-13 Avon A50 / 20.0/7.0-13 Avon A50

WHEELS (Fr / Rr) 7x13, 18mm offset, 2 pc Al Rim / 7x13, 18mm offset, 2 pc Al Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 30 kW

MOTOR TYPE Perm PMS 156W

MAX MOTOR RPM 6000

MOTOR CONTROLLER Infineon Hybridkit 1

MAX SYSTEM VOLTAGE 360V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiFePO4 / 5.6 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:4.5 / NA

DRIVE TYPE Chain drive with 116 chain links

DIFFERENTIAL Two seperated motors, different electrical torque regulation

COOLING Side pod mounted radiators with electrical water-pump

BRAKE SYSTEM 4-Disk system, self developed rotors with 240 outer diam., 160 inner diam., AP-Racing Calipers

ELECTRONICS Wiring harness sealed to IP67, Traction Control, Torque-vectoring, CAN, Multifunctional dashboard

KÖLN
University of Applied Sciences Köln

Car E12 Pit E24 Germany

After participating as a new formed team in the first Formula Student Electric competition ever in 2010 we are back with a strengthened team for our second season. We were joined by former team members of Formula Racing Cologne. To be competitive both decided to merge. The decision to building a formula student car corporately was taken in the first weeks in 2011. Based on the combined knowledge and experiences from past seasons we gained the great ability to compete. Adding additional technical skills in chassis-building to the existing excellence in constructing an electrical drivetrain enabled us to realize the very advanced eMC11. The basis for our development was to include a complete new designed drivetrain setup in a hybrid frame design with monocoque and bolt-on rear frame. Finally a team of student designers was assign to give the car the look it deserves.

FRAME CONSTRUCTION Monocoque front, rear tubular space frame

MATERIAL 15CDV6, 16mm to 25mm diameter tube

OVERALL L / W / H (mm) 2809 / 1386 / 1020

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1216 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 147 / 198

SUSPENSION Fr/Rr: Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) Hoosier R25B 20.5x7 R13 / Hoosier R25B 20.5x7.5 R13

WHEELS (Fr / Rr) 7x13", 3 piece Al/Mg BBS Rims

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear axle / 2x 36 kW

MOTOR TYPE LMC D135RAGS

MAX MOTOR RPM 4200

MOTOR CONTROLLER Kelly KDH 14601E

MAX SYSTEM VOLTAGE 146

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiFePo4 / 48

TRANSMISSION RATIO (PRIMARY / SECONDARY) 4.1:1 /

DRIVE TYPE Belt

DIFFERENTIAL Electric differential

COOLING Air

BRAKE SYSTEM Floating 220mm discs, 4/2 piston calipers (Fr/Rr), self developed ABS supported by TRW

ELECTRONICS Battery Management System, dSPACE Micro-AutoBox

LANDSHUT
University of Applied Sciences Landshut

Car E97 Pit E15 Germany

After a trip to Hockenheim in 2010, a little group of studends were influenced of the spirit of Formula Student. They decided to design and build their own electrically-powered racing car for the event in August 2011. LA-eRacing, with their 35 active teammembers from every faculty of our university, was founded in September 2011. It was a very long and exhausting way from the first idea over the concept decision to the final car. In addition to the design und the delineation of the technical features, the financing of the project was also a initial problem. But all odds, we have finally managed to build up a fully functional and hopefully competitive vehicle. Our „eR11" has two permanent excitated watercooled synchronous motors. Each motor has a maximum torque of 95Nm and continuous power of 30kW. The accumulator has an overall capacity of 10,6 kWh and nominal voltage of 345 V. For furhter informations please visit www.la-eracing.de

FRAME CONSTRUCTION tubular spaceframe with carbon floor plate

MATERIAL S355 steel round tubing 25mm diameter, 1.5mm, 2.0mm and 2.5mm wall thickness

OVERALL L / W / H (mm) 2952 / 1480 / 1153

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1700 / 1300 / 1250

WEIGHT WITH 68kg DRIVER (Fr / Rr) 206 / 252

SUSPENSION double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 20,5x7.0-13, Hossier R25

WHEELS (Fr / Rr) 7Jx13 H2 ET20 Al Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear / 2x30kW

MOTOR TYPE Perm Motor PMS156W

MAX MOTOR RPM 6000

MOTOR CONTROLLER Unitek Bamocar D3

MAX SYSTEM VOLTAGE 403

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiMn / 10,6

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:4,5 / -

DRIVE TYPE chain drive

DIFFERENTIAL Drexler limited slip differential

COOLING Twin side pod mounted radiators with thermostatic controlled electric fans

BRAKE SYSTEM 254 mm outer diam., 166 mm inner diam., grooved brake contact area, brake balance adjustable

ELECTRONICS VCU (ETAS ES910), CAN Bus, datalogger, drivers display

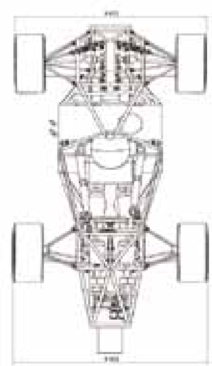
LISBOA

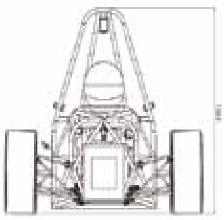
Technical University of Lisbon - IST

Car E50 Pit E5

Portugal

The FST 04e is the fourth car built by Projecto FST Novabase, during our 10 years of history. It is also our first electric one! After achieving an overall win in Class 2 of FS UK 2010, we are aiming to present a reliable and fast car this year in Germany.Our team consists of 19 enthusiastic students, all extra-curricular, from Mechanical, Electrical and Aerospace Engineering. We are the only team actively developing Formula Student cars in Portugal.Feel free to stop by our box, and have a chat with us, whether you are a visitor, a judge, or from a FS team! We are eager to learn as much as possible during this first participation in FSE, and feedback about our car is much appreciated!We also want to leave a word of gratitude to our Sponsors, always believing in our project, and making it a reality.Visit our team on www.projectofst.com or www.facebook.com/projectofst





FRAME CONSTRUCTION Tubular Space Frame

MATERIAL AISI 4130 round tubing 11mm to 25mm diameter and square tubing 25mm

OVERALL L / W / H (mm) 2954 / 1451 / 1269

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1230 / 1200

WEIGHT WITH 68kg DRIVER (Fr / Rr) 161 / 175

SUSPENSION Double unequal length A-Arm. Pull rod (Fr), push rod (Rr). Ohlins TTX 25 dampers.

TYRES (Fr / Rr) 195x89 R13, Avon A45

WHEELS (Fr / Rr) 7.2x13, 14mm offset, 3 pc AL Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Behind driver, inboard / 30kW per motor

MOTOR TYPE Agnimotors 95-R, Permanent Magnet DC Motors

MAX MOTOR RPM 6.000

MOTOR CONTROLLER Custom, MOSFET, High frequency PWM

MAX SYSTEM VOLTAGE 144V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiFePO4 / 7,68 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 5,8:1 / NA

DRIVE TYPE Chain

DIFFERENTIAL Torsen FSAE 012000, 4:1 TBR

COOLING Air cooling, with temperature monitoring

BRAKE SYSTEM 4-Disk system, floating steel rotors, 220mm dia; opposing pistons, 34mm dia Fr, 25,4mm dia Rr

ELECTRONICS Custom built data logger from CAN to USB drive with telemetry; custom built dashboard

MADRID

Polytechnic University of Madrid

Car E20 Pit E19

Spain

The UPM Racing electric team was founded in 2010 with all the eight years of experience of our brother UPM Racing combustion. Thus, a group of students in engineering in multiple fields decided to step in and accept the challenge of building an electric racing car, combining simplicity with performance. As a result, we have now a very practical car propelled by two rear electric motors which meets the most important pillars: reliability, performance and efficiency.Our car is the next step in evolution of racing cars, gathering all the qualities the racing world needs. Furthermore, it is not just a car it is our philosophy, „Evolution and Adaptation", those are the ideas people are excited about.That is why with pride, the UPM Racing electric team along with the Polytechnic University of Madrid present the UPM08e.

FRAME CONSTRUCTION Steel tube space frame with glued carbon fibre floor panels

MATERIAL 4130 Alloy Steel

OVERALL L / W / H (mm) 2890 / 1430 / 1058

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1230 / 1160

WEIGHT WITH 68kg DRIVER (Fr / Rr) 174 / 212

SUSPENSION Unequal length A-Arms. Push rod actuated Cane Creek ST44 spring/damper F-SAE specific units.

TYRES (Fr / Rr) 20.5x7.0-13 Hoosier R25B / 20.5x7.0-13 Hoosier R25B

WHEELS (Fr / Rr) 13 x 7 / 13 x 7

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear / 34 kW each

MOTOR TYPE DC-Motors air cooled: Lynch Motor Company

MAX MOTOR RPM 4400

MOTOR CONTROLLER Kelly KDH12121E

MAX SYSTEM VOLTAGE 96V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY / 9.6 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:3.8 /

DRIVE TYPE #530 chain

DIFFERENTIAL FSAE Drexler Limited Slip Differential with friction plates, adjustable

COOLING Air cooling with electric fan

BRAKE SYSTEM 4-Disk system, self developed rotors with 220mm diameter, adjustable brake balance

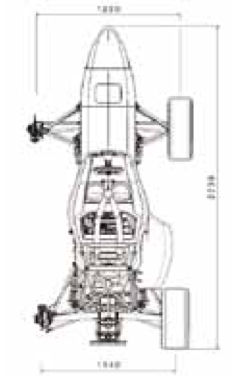
ELECTRONICS

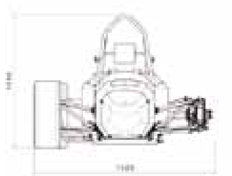
MÜNCHEN
Technical University of München

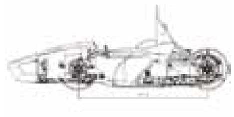
Car E21 Pit E21

Germany

The TUfast e-Technology Team is a newly founded team of 24 students. Of course we are very closely linked to our ICE-car team, but only four of us have built a FS-car before. Our biggest challenge this year turned out to be the multidisciplinarity of an electric car. To combine the different views and working techniques of electrical and mechanical engineers wasn't always easy.Despite the challenges we managed to complete our first e-racecar: the eb011. As a basis for the mechanical parts we were able to refine some of the concepts that already proved to be fast in our previous ICE-car nb010. It features a lighter monocoque and a stiffer rear frame. On the electric side our unique features are the two powerful motors, each powering one rear wheel in a direct drive installment without the need for a transmission.We had a great time designing and building this car and now we're looking forward to celebrating with you at the competition!







FRAME CONSTRUCTION CFRP Monocoque with tubular steel rear space frame

MATERIAL texTreme with rohacell and aluminium honeycomb as sandwich core

OVERALL L / W / H (mm) 2736 / 1423 / 1037

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1610 / 1220 / 1140

WEIGHT WITH 68kg DRIVER (Fr / Rr) 124 / 183

SUSPENSION Double unequal length A-Arm. Pull rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 178x54 R13 Hoosier R25B

WHEELS (Fr / Rr) 191x47 R13 Hoosier R25B

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER
2 / Rear Right, Rear Left / 50kW/100kW peak per motor

MOTOR TYPE permanent synchronous machines

MAX MOTOR RPM 2000

MOTOR CONTROLLER Tech-Ops sevcon evolution 5

MAX SYSTEM VOLTAGE 400

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY
LiPo / 8,15kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1 / 1

DRIVE TYPE direct driven

DIFFERENTIAL fully electronic

COOLING sidepod mounted radiator with electronic controlled fan

BRAKE SYSTEM 2x 235mm discs plus 4piston calipers at front and 2x 200mm discs plus 4piston calipers at the rear

ELECTRONICS traction control, launch control, active yaw control + active differential, 2x 1 Mbit/s CAN Bus

MÜNCHEN
University of Applied Sciences München

Car E77 Pit E18

Germany

After the first participation of the municHMotorsport electric team at the FSE event in Hockenheim in 2010, we are full of anticipation for the next round in 2011. With an almost newly-formed team of about 50 highly motivated students of numerous faculties we have developed a completely new vehicle, the ePassionWing 2.11. Contrary to last year, the load-bearing structure of the new car will be a tubular frame structure which is surrounded by a laminated carbon paneling. A 100 kW strong engine, supplied by the swizz company Brusa, and a chain drive with the ratio 1:5 bring a torque of 1000 Nm to street. And the two battery containers on the left and right side of the car with a complete capacity of 7 kWh supply enough energy for this engine. Together with our strong partners we have manufactured a competitive car which will be recognized in Hockenheim and our complete team is keen on the challenge at the different events. Feel the passion with the municHMotorsport electric team!

FRAME CONSTRUCTION tubular spaceframe

MATERIAL steel (15CdV6, 25CrMo4)

OVERALL L / W / H (mm) 2816 / 1450 / 1116

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1200 / 1160

WEIGHT WITH 68kg DRIVER (Fr / Rr) 148 / 182

SUSPENSION Double unequal lenght A-Arm. Pull rod actuated horizontally orineted spring and damper.

TYRES (Fr / Rr) 20,5x7 R13, Hoosier R25B

WHEELS (Fr / Rr) 20,5x7 R13, Hoosier R25B

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER
1 / Rear Middle / 100

MOTOR TYPE Kräutler HSM6.17.12

MAX MOTOR RPM 11.000

MOTOR CONTROLLER Brusa DMC524

MAX SYSTEM VOLTAGE 400V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY
Lithium-Mangan / 8 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:5 / n/a

DRIVE TYPE Chaindrive

DIFFERENTIAL Drexler multi disc limited slip differential

COOLING Water cooling system, radiator mounted on top of the heat exchanger.

BRAKE SYSTEM Floating disc, hub mounted, 240mm dia., thickness 4mm, stainless steel.

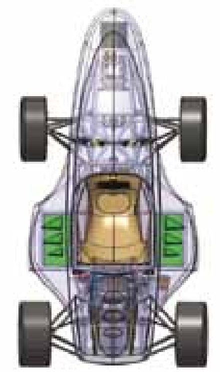
ELECTRONICS wiring harness sealed to IP67, multifunctional steering wheel, traction control system

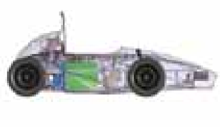
OSNABRÜCK

University of Applied Sciences
Osnabrück

Car E67 Pit E20

Germany





FRAME CONSTRUCTION tubular steel space frame

MATERIAL 25CrMo4

OVERALL L / W / H (mm) 2853 / 1420 / 1160

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1676 / 1220 / 1195

WEIGHT WITH 68kg DRIVER (Fr / Rr) 152 / 228

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 20.5x7 R13, Hoosier R25A

WHEELS (Fr / Rr) 20.5x7 R13, Hoosier R25A

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 26kW, 26kW

MOTOR TYPE Vues AFW637H

MAX MOTOR RPM 5000

MOTOR CONTROLLER self made

MAX SYSTEM VOLTAGE 554V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY Li-NMC / 8,59kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:4,1 / -

DRIVE TYPE 5/8 x 1/4 inch Chain

DIFFERENTIAL Torque sensitive limited

COOLING Rear mounted 1300cc radiator and 186mm electric fan

BRAKE SYSTEM 4-Disk system floating,carbon,hub mounted,124mm outer diam,AP Racing 16.8 mm diam.Sicom dual piston

ELECTRONICS wiring harness sealed to IP67, Multifunctional Steering Wheel,Traction control,CAN-BUS

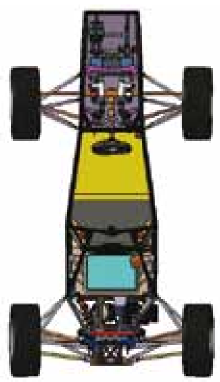
For the current Formula Student season of 2011 the Ignition Racing Team designed the IR 11. Founded in 2006 the Team now starts with its new racing car into the fifth season. Thanks to the support of many new team members we were able to manufacture the new IR11. After last years good performance of the IR 10, the team decided to take up a new challenge. For the Formula Student season 2011 we decided to participate in the electrical competition for the first time. The IR 11 bases upon a tubular space frame and is powered by two permanent excitated water-cooled synchronous motors. The two Li-NMC batteries are mounted in the side pots. They provide enough energy to generate a maximum power output of 26kW per motor. Each motor directly transfers its torque to the rear tires by a chain drive. That makes a differential unnecessary. We would like to thank our University, our Sponsors and everyone who supported us building this car and we are looking forward to an exciting FSE competition.

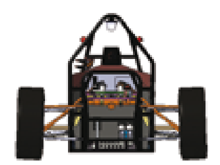
PRAGUE

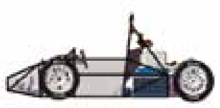
Czech Technical University in Prague

Car E34 Pit E26

Czech Republic







FRAME CONSTRUCTION Hybrid tubular space frame with Aluminium sandwich panels; Aluminium welded rear section

MATERIAL Steel tubes S235; Sandwich skin EN AW 2024, core aluminium honeycomb; rear section EN AW 6082

OVERALL L / W / H (mm) 2937 / 1365 / 1105

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1700 / 1250 / 1264

WEIGHT WITH 68kg DRIVER (Fr / Rr) 178 / 201

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) Hoosier R25A - 20.5x7.0 - 13 / Hoosier R25A - 20.5x7.0 - 13

WHEELS (Fr / Rr) 7"x13" O.Z / 7"x13" O.Z

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 1 / in front rear axle / 72 kW

MOTOR TYPE Freeair Teratex 80kW

MAX MOTOR RPM 12000

MOTOR CONTROLLER MGM Compro custom build

MAX SYSTEM VOLTAGE 232V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo / 8,29

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:3 / 1:2,63

DRIVE TYPE Planetary gearbox + chain 520

DIFFERENTIAL Torsen-University Special 012000 limited slip differential

COOLING Single side pod mounted radiator, Air cooled battery pack

BRAKE SYSTEM 4-Disk system;Fr 250mm hub mounted, Rr 220mm differential mounted; adjustable brake balance

ELECTRONICS Active cooled battery pack, self designed control system

Two Teams, Two Cars, One Challenge! We have made 3 cars with internal combustion motor and we made our first electric formula. History of CTU CarTech team has begun in 2009. After 2 years we managed to take part in Formula Student Electric. Our team has been personally splitted into two parts.Our Formula has hybrid tubular frame with aluminium sandwich panels. For traction we use custom developed three phase BLDC motor with it's own motor inverter. The power to is transfered by palanetary gearbox and chain gear. Motor and gearbox are placed in aluminium frame. Powerful LiPo batteries give us 400 A and 230 V. Baterries are placed in lightweight baterry pack. Self developed Control System based on Mbed microcontroller gives us very easy way how to create our wishes.Taking part in competition like this is big satisfaction for our work. Let's meet at Hockenheim!

RAVENSBURG
Baden-Württemberg Cooperative State University Ravensburg

Global Formula Racing is the first innovative global collaboration of its kind in the history of both, the US-based Formula SAE and the EU-based Formula Student programs. The former BA-Racing-Team from the Duale Hochschule Baden-Württemberg (DHBW-RV), and the Beaver Racing team from Oregon State University (OSU) have combined forces to compete as a single entity in 2010. The two universities since then share physical and intellectual resources to create a highly competitive vehicle worthy of international reputation. In 2011, we will reconfirm our successful season from 2010. This will be achieved by using the effective 2010 basis and build one car with a combustion drivetrain, and one car with an electric drivetrain. The combustion car will be manufactured and tested at the OSU campus in Corvallis, Oregon, USA and the electric powered car at the DHBW-RV, Friedrichshafen, Germany. Both cars will compete side by side.

Car E110 Pit E31

Germany

FRAME CONSTRUCTION Full Monocoque / Steel Roll Hoops

MATERIAL Toray T700SC-12k Plain Weave Fabric, Flexcore nomex honeycomb, 1020 DOM mild steel

OVERALL L / W / H (mm) 2474 / 1328 / 1160

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1555 / 1120 / 1120

WEIGHT WITH 68kg DRIVER (Fr / Rr) 120 / 160

SUSPENSION Double unequal length A-Arm.Pull rod(fr)/Push Rod(Rr) actuated spring and damper

TYRES (Fr / Rr) 7.0/18.0-10 LC0 Hoosier

WHEELS (Fr / Rr) 10" diameter, 7" wide, 3 pc Al Rim, 2 inch neg. offset

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 1 / rear / 76kW

MOTOR TYPE Remy HVH250

MAX MOTOR RPM 10600

MOTOR CONTROLLER RMS PM100

MAX SYSTEM VOLTAGE 395V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPO / 7kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) /

DRIVE TYPE 520 non-O-ring chain

DIFFERENTIAL clutch pack limited slip, adjustable preload preload, lockable

COOLING

BRAKE SYSTEM 4-Disk system, custom floating(168/163mm),32/25mm dia,dual piston, fixed mount, Brembo/AP

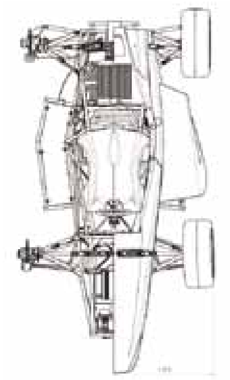
ELECTRONICS Motec ADL3, BCU, CCU,

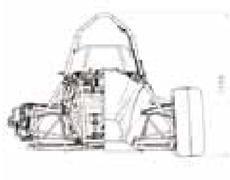
REGENSBURG
University of Applied Sciences Regensburg

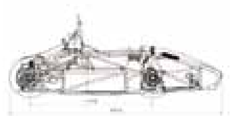
The regenics Formula Student Electric Team of the University of Applied Sciences (UAS) in Regensburg was founded in 2010 by the experienced team members out of the Formula Student Combustion Team. We are very proud to integrate over 50 members from nearly all faculties of the university in one team. Every team member is part of a subteam and has clearly defined tasks for which he is fully responsible. This season we will participate the first time in the competition and tried to fulfill our own expectations of our first electric race car. One highlight of our ‚RP 11e' is the virtual differential, which is provided by the use of two motors on separated rear driveshafts. Furthermore a light suspension consisting of carbon a-arms and aluminum wheel carriers should be mentioned. We are looking forward to meet the other teams and to have a great competition!

Car E62 Pit E12

Germany







FRAME CONSTRUCTION Tubular space frame with carbonfibre sandwich floor panels

MATERIAL S235JR

OVERALL L / W / H (mm) 2715 / 1500 / 1069

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1575 / 1250 / 1210

WEIGHT WITH 68kg DRIVER (Fr / Rr) 163 / 245

SUSPENSION Double unequal length A-Arm with anti-features. Pushrod actuated y-axis oriented spring and damper

TYRES (Fr / Rr) 205/510 R13 34M Continental

WHEELS (Fr / Rr) 205/510 R13 34M Continental

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Left, Rear Right / 30 kW, 30 kW

MOTOR TYPE Perm PMS-156W

MAX MOTOR RPM 6000

MOTOR CONTROLLER Infineon HybridKit 2

MAX SYSTEM VOLTAGE 475

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiFePO4-based Cathode/Carbon-based Anod / 5,82 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:1 / 1:4,6

DRIVE TYPE 428 chain drive

DIFFERENTIAL Virtual, sensor-driven differential

COOLING Liquid cooled motors, liquid cooled power electronics

BRAKE SYSTEM 4-Disk system, self developed rotors, adjustable brake balance

ELECTRONICS MicroAutoBox II as Drive-Controlunit, CAD designed wiring harness, multiple driving dynamics sensors

SIEGEN
University of Siegen

Car E107 Pit E11

Germany

After the Speeding Scientists Siegen built combustion cars in the last two years and became the Best Newcomer in 2009 and improved to an 22nd overall place last year, 2011 we're starting with our first electric race car.The concept and design phase was started in autumn 2010. After the construction phase in spring 2011 the new car was presented on July, 5th in Siegen. The main design goals of the S3-11e were to build a robust and reliable car again, while improving the weight of the mechanical components to compensate the higher weight for the entire electric drivetrain. For this reason we've also installed a carbon-fiber suspension for the first time. A self developed gearbox transfers the power of the motors to both rear wheels. As both motors are controlled independently we're using a self developed control layout which includes torque vectoring system, traction control, energy recovery and an electronic differential.

FRAME CONSTRUCTION Steel space-frame construction with round and square tubes

MATERIAL E235 + CR1S2 frame tubing / Carbon fiber sandwhich floor panel / Carbon fiber bodywork

OVERALL L / W / H (mm) 2860 / 1423 / 1195

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1620 / 1220 / 1175

WEIGHT WITH 68kg DRIVER (Fr / Rr) 143 / 215

SUSPENSION Double wishbone, push rod actuated spring and damper, adjustable in compression and rebound range

TYRES (Fr / Rr) 205x70 R13, Hoosier R25B

WHEELS (Fr / Rr) 7.0x13, 22mm offset, 1 pc OZ Racing Aluminium Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear right and left / 2x 52 kW

MOTOR TYPE Siemens 1FT6084

MAX MOTOR RPM 7900

MOTOR CONTROLLER Siemens SINAMICS S120

MAX SYSTEM VOLTAGE 598V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo - aluminium/tombac / 6920

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:5.56 /

DRIVE TYPE Self developed bevel helix gearbox

DIFFERENTIAL Electronic differential with corner radius and speed based stiffness

COOLING Airflow through sidepods targeted on the motors and the frequency converters

BRAKE SYSTEM 4 disk system, self developed rotors with 240 / 220 (F/R) mm diameter, adjustable brake balance

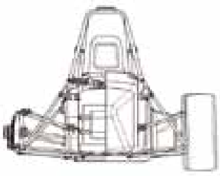
ELECTRONICS Self developed BMS, self developed model-based drive control system, system sealed to IP67

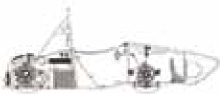
STOCKHOLM
KTH Royal Institute of Technology

Car E71 Pit E27

Sweden

KTH Racing was founded in 2003 and has built one car per year since then, focusing on the European FS competitions. This year we have a highly motivated multinational team of around 30 students from all 3 levels of university education. Our aim in the concept ideation of our newest car, the KTH R8e, was to have medium power in a low-to-medium weight car to make it both maneuverable and efficient. In the design of specific parts we strive to make them as simple and robust as possible, with the goal to ease manufacturing and servicing as much as possible. What makes our car stand out is the fact that the chassis is built in a modular way to allow us to switch out its rear part in a matter of hours. This added flexibility allows us to run the car as either a internal combustion engine car or an electric car. In this competition we are focusing on the latter application, as we make our debut into the electric class of FS.





FRAME CONSTRUCTION Front and rear carbon fiber monocoque split behind the firewall

MATERIAL 340 gram/sqm pre preg carbon fiber and nomex honeycomb

OVERALL L / W / H (mm) 2857 / 1519 / 1094

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1272 / 1250

WEIGHT WITH 68kg DRIVER (Fr / Rr) 135 / 165

SUSPENSION Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 205x55 R13 Hoosier R25B / 205x55 R13 Hoosier R25B/

WHEELS (Fr / Rr) 7x13, 0mm offset, 3 pc Al/carbon Rim / 7x13, 0mm offset, 3 pc Al/carbon Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear center / 30kW each

MOTOR TYPE Permanent magnet brushed DC

MAX MOTOR RPM 6000

MOTOR CONTROLLER Kelly controls KDC 72601

MAX SYSTEM VOLTAGE 84

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo / 5,9 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 4.61 / n/a

DRIVE TYPE two 428 chains

DIFFERENTIAL n/a

COOLING Air cooled with side scoops and thermostatic controlled electric fans

BRAKE SYSTEM 4-Disk system floating rotor, 235 mm outer diam. ISR 4 pistons calipers adjustable brake balance

ELECTRONICS Torque vectoring, Race Technology DL-1 data logger, unidirectional radio modem, CAN bus 500Kbit/s

STUTTGART
University of Stuttgart

Car E1 Pit E29

Germany

GreenTeam Uni Stuttgart e.V. - the formula student electric team of the University of Stuttgart - was founded in 2009. This year the GreenTeam participates in the formula student electric event in Hockenheim for the second time. The team consists of 30 students from different fields of study, which are very engaged to construct, manufacture and build the second electric car generation - the E0711-2. The aim was to optimize the old car in different aspects. For example by increasing the efficiency, improving the driving control and battery cells and further reducing weight. Furthermore the vehicle features a variety of innovative components, such as the self-developed battery-management-system. So for the GreenTeam the course is set to live up to last year's success.

FRAME CONSTRUCTION Two-piece carbon fiber reinforced plastic monocoque

MATERIAL CFRP two piece monocoque, sandwich construction with epoxy matrix, 20mm aluminium honeycomb

OVERALL L / W / H (mm) 2685 / 1436 / 1055

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1620 / 1234 / 1172

WEIGHT WITH 68kg DRIVER (Fr / Rr) 142 / 196

SUSPENSION Double unequal length A-Arm. Pushrod actuated ZF Sachs Formula 3 Damper

TYRES (Fr / Rr) 205x70 R13, Hoosier R25B / 200 X 75 R13

WHEELS (Fr / Rr) 7.0x13 28mm offset Al Rim / 7.5x13 28mm offset Al Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 50kW

MOTOR TYPE AMK DT7-80-20-POW

MAX MOTOR RPM RR,RL: 9.000

MOTOR CONTROLLER AMK KW 60

MAX SYSTEM VOLTAGE 588V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPO (Li: 1,1 NiCoMnO2: 0,9) / 8,4 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:5,5 /

DRIVE TYPE Self designed gearbox

DIFFERENTIAL Seperate gearbox with two stage, straight tooth angular (90°) and spur gearing

COOLING Single U-Flow Radiator Sidepod mounted with PWM controlled fan and waterpump

BRAKE SYSTEM 4-Disk system, self designed floating disk, balance bar, 2x ISR 21-014 master cyl., Bosch ABS M4

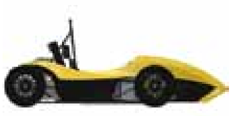
ELECTRONICS Self designed control-, diagnostic- and ECU network-system, selfdesigned pre- and discharge system

WIESBADEN
University of Applied Sciences RheinMain

Car E65 Pit E17

Germany

After developing three combustion cars – SPR08 to SPR10 – and successful participations in Hockenheim, Austria and Italy last year the Scuderia Mensa of HS RheinMain Racing will get part in the new electric class of Formula Student in its fifth year after foundation. The new SPR11e bases on the experiences we gained during manufacturing our combustions. Last year's proven parts were optimized and adapted to the new requirements the electric drives has brought with it. Besides some changes e.g. on the body-kit and improvements concerning the chassis, the development of the electric tractive system and drivetrain has been mastered by a team of Designer, Electric, Economic and Mechanical Engineering Students in collaboration with our sponsors. Our goal is to build a car that has at least the same performance, reliability, safety and ergonometric qualities as the SPR10. Therefore we worked hard and will participate successfully at the Hockenheimring and in Turin (ITA) this year.



FRAME CONSTRUCTION Space frame

MATERIAL E235/E355 steel round tubing/ 14mm to 25mm outer diameter

OVERALL L / W / H (mm) 2635 / 1433 / 1112

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1650 / 1230 / 1180

WEIGHT WITH 68kg DRIVER (Fr / Rr) 158 / 237

SUSPENSION Double unequal length A-Arm. Push rod actuated spring and damper.

TYRES (Fr / Rr) 20.5x7.0 R13 Hoosier R25B

WHEELS (Fr / Rr) 7x13, -28mm offset, 1 pc Al Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 65kW , 65kW

MOTOR TYPE RR , RL : Sineton Perm Synchronous Motor

MAX MOTOR RPM RR , RL : 3.000

MOTOR CONTROLLER modified Actua

MAX SYSTEM VOLTAGE 350V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY Li(NiCoMn)O2 / 10,85kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:1,95 / -

DRIVE TYPE Chain

DIFFERENTIAL Electrical Differential

COOLING twin side pod mounted Mini radiators with thermostatic controlled electric fans

BRAKE SYSTEM Floating supported rotors with 220mm diameter, adjustable brake balance, 4 piston calipers

ELECTRONICS wiring harness sealed to IP67, Live-Telemetry System

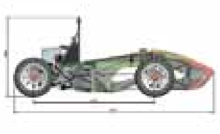
WOLFENBÜTTEL

University of Applied Sciences Ostfalia

Car E35 Pit E4

Germany

This year team wob-racing decided to step into the development of future technologies and take part in the Formula Student Electric. With that decision wob-racing looks for a new challenge after building combustion racecars for seven years. During that time we could collect a lot of important experiences with combustion engines. That is why we decided not to switch the type of drive completely but to build two independent cars. With a clever developing strategy this decision brings us the possibility to create a lot of synergy effects which save time and money. That is why we formed a common platform that is the basis for both cars. We also set ourselves again several main targets. Our whole development is affected by these simple main goals. These targets are: 1.) Reliability 2.) Safety 3.) Performance 4.) Quality. This new task meant to be the biggest step since the team foundation in 2003 and it challenged us in many ways. The more proud we are to present the result: The WR07-E!



FRAME CONSTRUCTION tubular space frame

MATERIAL E 335

OVERALL L / W / H (mm) 2637 / 1464 / 1056

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1600 / 1260 / 1230

WEIGHT WITH 68kg DRIVER (Fr / Rr) 167 / 209

SUSPENSION Double unequal length A-Arm. Pushrod actuated horizontally oriented spring and damper.

TYRES (Fr / Rr) 20,5x6.0-13, Hoosier R25B / 20,5x7,0-13 Hoosier R25B

WHEELS (Fr / Rr) 6.0x13, 0mm offset, 3pc Mg/Al Rim / 7,0x13, 0mm offset, 3pc Mg/Al Rim

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear / 77,4kW

MOTOR TYPE RR,RL: self designed pms motors

MAX MOTOR RPM RR, RL: 11.700

MOTOR CONTROLLER industr. componenst, ext. functions

MAX SYSTEM VOLTAGE 420V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiNMC / 9 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:3,4 / 1:2,9

DRIVE TYPE double stage spur wheel gearbox

DIFFERENTIAL electronic differential

COOLING single side pot mounted heat exchanger, thermostatic controlled water pump

BRAKE SYSTEM 4-Disks, self designed rotors, front: 230mm dia, Beringer 4-piston, rear: ABM 2-piston, 203mm dia

ELECTRONICS multifunctional steering wheel, self designed power management, HV control unit, measuring unit

ZÜRICH

Swiss Federal Institute of Technology Zurich

Car E33 Pit E10

Switzerland

Anno domini 2007, AMZ Racing Team started in Formula Student as a newcomer with the 255 kg, 10", four-cylinder racer „albula". Subsequently, our team chose a carbon monocoque as chassis concept and 13" wheels for „maloja" (petrol), „simplon" (E85) and „furka" (our first electric car).2010 was the most successful year in our team history with an overall win in Class 1A, Formula Student Silverstone (957/1000 pts), a first place in Engineering Design at Hockenheim and a 5th place overall and 3rd in Design in Melk, Austria (against 24 IC and 4 electric cars).AMZ's latest creation „novena" is a car that uses all the experience from last year and improves the weakest points of „furka". A strong focus on lightweight construction yielded a 190 kg, 70 kW electric car with 13" carbon rims, a single-piece monocoque and two self-developed electric machines (permanent magnet synchron outrunner). Our goal for 2011 is to be as fast as the best IC cars on the track and win an event.

FRAME CONSTRUCTION Single-piece CFRP prepreg monocoque

MATERIAL 200 gsm prepreg carbon (twill and unidirectional) with various thickness aluminum honeycomb

OVERALL L / W / H (mm) 2610 / 1430 / 1030

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1550 / 1200 / 1160

WEIGHT WITH 68kg DRIVER (Fr / Rr) 119 / 139

SUSPENSION Double wishbone unequal length carbon A-arms. Pull rod actuated coilover spring and damper.

TYRES (Fr / Rr) Hoosier R25B 20.5x7.0-13

WHEELS (Fr / Rr) 7.5x13 CFRP prepreg 22 mm offset

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 2 / Rear Right, Rear Left / 36 kW, 36 kW

MOTOR TYPE RL, RR: AMZ M1

MAX MOTOR RPM RL, RR: 6.500

MOTOR CONTROLLER Semikron SKAI 35 A2 MM20-W

MAX SYSTEM VOLTAGE 152

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY Li - graphite / 7 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) 1:5.12 / n/a

DRIVE TYPE Dual two-stage gear transmission

DIFFERENTIAL Individual rear wheel drive, aluminium tripod housings, carbon driveshafts with integrated tripods

COOLING Side-mounted aluminum radiator, serial cooling circuit for controller and motors

BRAKE SYSTEM 4-Disk system

ELECTRONICS multi-input / multi-output steering wheel, self developped VCU software

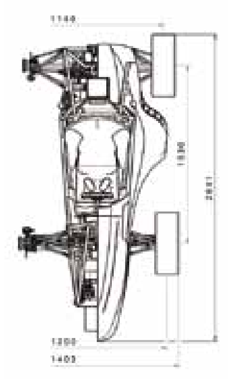
ZWICKAU

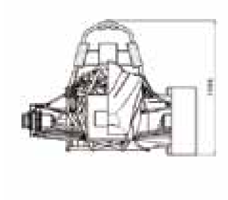
University of Applied Sciences Zwickau

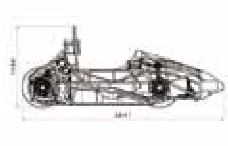
Car E96 Pit E2

Germany

„Innovation meets Tradition" - if you look at Zwickau's automotive history you can easily find out why we picked out this slogan for our team. Zwickau is the birth place of Horch and Audi, and furthermore in the 1930s, it was the domicile of the Auto Union race cars which dominated the race tracks in Europe. Almost 70 years later our WHZ Racing Team was founded. Now in 2011, we bring our second full electric car to the tracks. The FP511e (code name: e.Gon) is a further development of last year's successful car, concentrating on packaging, calibration and reliability. We created a fast and dynamic car with four independent motors and self-developed electronic components.Nowadays, our team consists of about 60 members from a variety of faculties of the UAS Zwickau. This team has worked hard and efficiently to upgrade its results for the season 2011. The FSE opens a door to a new dimension of racing - so let us all have fun and create the future together. www.whz-racingteam.de







FRAME CONSTRUCTION Tubular spaceframe with intigrated energy storage container

MATERIAL Chromoly 4130 steel tubes - cold drawn seamless; 1in and 0.625in dia

OVERALL L / W / H (mm) 2641 / 1403 / 1060

WHEELBASE (mm) / TRACK (Fr / Rr) (mm) 1530 / 1200 / 1140

WEIGHT WITH 68kg DRIVER (Fr / Rr) 119 / 145

SUSPENSION Unequal length, nonparallel A-Arms. Push rod actuated Cane Creek spring/damper units

TYRES (Fr / Rr) 20 x 7.0 - 13 R25A Hoosier

WHEELS (Fr / Rr) 20.5 x 7 - 13; CFRP rim bed, aluminium star

NUMBER OF MOTORS / LOCATION / MAX MOTOR POWER 4 / Hub Motors;Central Motors / 2 x 7 kW + 2 x 32 kW

MOTOR TYPE PMSM; Front:: industrial; Rear: self-designed

MAX MOTOR RPM FL, FR: 18,000; RR, RL: 6,000

MOTOR CONTROLLER Industrial, adapted to the car

MAX SYSTEM VOLTAGE 400V

ELECTRODE MATERIALS / COMBINED ACCUMULATOR CAPACITY LiPo / 8 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY) F: 4.55 / R:12.45

DRIVE TYPE Front: planetary gear; Rear: spur gear

DIFFERENTIAL Electronic differential

COOLING Left side pod mounted radiator

BRAKE SYSTEM Cast Iron, disc hub mounted, front 240mm, rear 230mm dia.

ELECTRONICS Vehicle Dynamic Drive Control (VDDC), BMS, wiring harness sealed to IP67, cental electric system

FSG DICTIONARY

FSG WÖRTERBUCH

acceleration	Beschleunigung
accessories	Zubehörteile
accumulator	Akkumulator
adhesive	Klebstoff; kleben
angle	Winkel
autocross / sprint	eine schnelle Runde auf dem Rundkurs
battery	Batterie
bearing	Lager
bodywork	Verkleidung
bolt	Bolzen, Schraube
bore	Bohrung
brake	Bremse; bremsen
business model	Geschäftsmodell
business plan	Geschäftsplan
caliper	Bremssattel
camber	Sturz
camshaft	Nockenwelle
carbon fibre	Kohlefaser
caster; caster angle	Nachlauf; Nachlaufwinkel
centre of gravity	Schwerpunkt
chain	Kette
chain guard	Kettenschutz
charge	Ladung; laden
charging station	Ladestation
chassis	Fahrwerk, Fahrgestell, Rahmen bzw. Monocoque
clutch	Kupplung; kuppeln
component	Bauteil
composite materials, composites	Verbundwerkstoffe
compression ratio	Verdichtungsverhältnis
control system	Steuerungssystem
cooling	Kühlung, Kühlsystem
crankshaft	Kurbelwelle
current	Strom
cylinder	Zylinder
damper	Dämpfer
dashboard	Armaturenbrett
design	Entwurf, hier: Konstruktion; konstruieren
differential	Differential (-getriebe)
displacement	Hubraum
drive shaft	Antriebswelle
drive train	Antriebsstrang
efficiency factor	Wirkungsgrad
(driver) egress test	5-Sekunden-Ausstiegstest
electronic control unit (ecu)	elektronisches Steuergerät
emergency switch	Notaus-Schalter
endurance	Ausdauer, hier: Langstreckentest
energy efficiency	Energieeffizienz
energy meter	Messgerät für elektrische Energie
engine	Motor
evaluation	Bewertung
executive summary	Zusammenfassung des Geschäftsplans
exhaust	Auspuff
exhaust system	Abgasanlage
fibre composites	Faserverbundwerkstoffe
fire extinguisher	Feuerlöscher
firewall	Feuerschutzwand
force	Kraft
frame	Rahmen
fuel consumption	Kraftstoffverbrauch
fuel economy	Kraftstoffverbrauch
fuel efficiency	Kraftstoffeffizienz
fuel injection	Kraftstoffeinspritzung
fuse	Sicherung
gear	Gang
gearbox	Getriebe
glass fibre	Glasfaser
glue	Klebstoff; kleben
ground	Masse
handling	Fahrverhalten
hub	Nabe
HV (high voltage)	Hochspannung
impact attenuator	Crashbox
insulation monitoring device (IMD)	Isolationsüberwachungssystem
intake manifold	Ansaugtrakt
intake system	Ansaugsystem
in-wheel motor	Radnabenmotor
jack	Wagenheber
judge	Juror, Jurymitglied; bewerten
lap	Runde
lateral forces	Seitenkräfte
LV (low voltage)	Niederspannung
manufacture	Fertigung, Herstellung; fertigen
marshal	Streckenposten
monocoque	Karosserie in Schalenbauweise
motor	elektrischer Motor
nut	Mutter
peak power design (rpm)	Entwicklungszieldrehzahl für Spitzenleistung
peak torque design (rpm)	Entwicklungszieldrehzahl für Spitzendrehmoment
petrol	Benzin
penalty	Strafe
piston	Kolben
pit	Box
power design (rpm)	-> peak power design (rpm)
push bar	hier: Vorrichtung zum Schieben des Fahrzeugs
push rod	Druckstab, insbesondere an der Radaufhängung
rain test	Beregnungstest
range	Reichweite
regenerative braking	Rekuperation
restrictor	Restriktor, Luftmengenbegrenzer
rim	Felge
rivet	Niete; nieten
rocker arm	Umlenk-, Kipphebel
roll hoop	Überrollbügel
rpm	U/min
safety harness	Rückhaltesystem
scrutineering	technische Sicherheitsüberprüfung
shift	schalten
shim	Rückhaltesystem
side impact	Seitenaufprall
Skid Pad	Skid Pad, Befahren einer Acht
slick	profilloser Reifen
spaceframe	aus Profilen zusammengesetzter Rahmen
spring	Feder
steel tube space frame	Gitterrohrrahmen aus Stahl
steering	Lenkung
steering lever	Spurhebel
steering rack	Zahnstange
steering wheel	Lenkrad
stiffness	Steifigkeit
strenght	Festigkeit
stroke	Hub
suspension	Fahrwerk, insb. Federungssystem
suspension arms	Fahrwerksstreben
suspension loads	Fahrwerkslasten
technical inspection	technische Abnahme
throttle	Drosselklappe; drosseln
tie rod	Spurstange
toe	Vorspur
torque	Drehmoment
torque curve	Drehmomentverlauf
torque design (rpm)	-> peak torque design (rpm)
torque encoder (throttle pedal position sensor)	Gaspedalpositionsgeber
torque vectoring	Lenkungsunterstützung durch Antriebsmoment
track	Spurweite
traction control	Traktionskontrolle
tractive system	Antriebssystem
tractive system active light (TSAL)	Hochspannungswarnleuchte
transmission	Getriebe (insb. bei elektrischen Fahrzeugen)
tube	Rohr
tyre	Reifen
valve	Ventil
voltage	Spannung
washer	Unterlegscheibe
weld / weld seam	Schweißnaht
wheel	Rad
wheelbase	Radstand
wheel hub motor	Radnabenmotor
wing	Flügel, Spoiler
wiring harness	Leitungsstrang

In the team profiles, you find so called QR Codes, a two-dimensional bar code. It includes a link to the team page on the FSG website.
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