

# Formula Student Germany



AN INTERNATIONAL DESIGN COMPETITION OF SKILLS, SPEED AND SPIRIT

6<sup>TH</sup> - 12<sup>TH</sup> AUGUST 2018 | HOCKENHEIM

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A special thanks goes to the numerous volunteers who contributed significantly in the realisation of the thirteenth Formula Student Germany.



For those working in the Automotive industry, or in other This year, as part of introducing our Time-Keeping team, we Advanced technology industries, you may, like myself, see advancements accelerating faster than ever before.

skills and continue to expand their knowledge. This can only benefit them when the time comes to plunge into the real world on graduation.

During the research in creating the articles we have provid- engineers, to design and build another race car, years after ed you within this year's FSG Magazine, it has been so in- they graduated. If you had the chance to build another race spiring to see just how driven the Formula Student world is. car, or to build a race car for the first time - what would you Not only are the teams learning amongst themselves how to further develop their cars for the latest Formula Student Driverless competition, but they are also networking be- I hope you enjoy reading this magazine as much as the team tween the different universities to spread the knowledge. This can only improve the technology and the competition as a whole: sound ideas become proven reality.

The world is becoming a smaller place as rapid and eco- stage at the Award Ceremony! nomic transport between cities, countries and continents has increasingly become the norm. For example, one of our Dipl.-Ing. Alia Pierce established teams from Monash in Australia is returning this year to compete at FSG. We decided to interview them (see page 130) to find out what pushes them to travel so far to Germany year after year.

FSG is very proud of the amount of innovation among our participants. Whether it is during their time as a team member, when they become a volunteer, or later as they develop their careers in pastures new. So many ideas have been turned to reality.

have looked to see what have been the most impressive inventions within Formula Student Germany (see page 74).

Formula Student Germany continues to push the limits. It The Formula Student bug is still strong. One part of editing provides students with an opportunity to fully develop their this magazine that I enjoy, is to search through all the FSG Media Team photos taken at last year's event. It is so great to spot all those people that I hadn't bumped into during the event, and to see that they keep coming back. I often hear the plans from my fellow FS friends, even as established choose? Combustion? Electric? Driverless?

and I had in putting it together.

I wish the teams competing at Formula Student Germany 2018 the best of luck and look forward to meeting you on









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# Introduction Einführung

# The Challenge

Formula Student Germany (FSG) is an international design com petition for university students, based on the Formula SAE rules and guidelines. Teams from around the world have the task of designing a single-seated, formula car with either a combustion or electric drive train and to then manufacture a functional prototype. They can then also velop a viable business plan and a marketing concept for batch production of the vehicle. The target group is amateur weekend racers, therefore, the racecar must not only must be developed include aesthetics, ergonomics, and use of off the shelf components. The vehicle designs are judged by experts from the automobile, motorsport and supply industries. The teams are then able to score points in various static and dynamic events, which will ultimately Formula Student Germany.

# **Practical Experience**

FSG enriches the teaching content of a course of study with challenging and practical experience in the fields rausfordernde und praktische Erfahrungen in den Beof manufacturing and production, whilst not neglecting reichen Konstruktion und Fertigung, ohne dabei die the practice-oriented requirements relating to profita- praxisrelevanten Voraussetzungen in Bezug auf Wirtbility and market relevance. The aspects assessed by the competition correspond directly to the demands of the different branches of the industry for new product development, which is why they are not merely restricted to vehicle design. By working as part of an interdisciplinary für den Fahrzeugbau anwendbar. Durch die Arbeit in eiteam of students from different fields of study and ex- nem interdisziplinären Team aus Studenten verschiedepertise, the competitors learn first-hand how to combine ner Studien- und Fachrichtungen lernen die Teilnehmer, the economic and technical goals of product develop- die wirtschaftlichen und technischen Ziele einer Proment and at the same time, how to defend the solutions duktentwicklung in Einklang zu bringen und dabei ihre they themselves have developed and assert these against competing developments.

# Herausforderung

Die Formula Student Germany (FSG) ist ein internationaler Konstruktionswettbewerb für Studenten, der sich an den Formula-Student-Wettbewerb der amerikanischen Society of Automotive Engineers (SAE) anlehnt. Die Aufgabe für die Teams aus der ganzen Welt besteht darin, ein einsitziges Formel-Fahrzeug mit einem Elektrik- oder Verbrennermotor zu konstruieren und einen fahrfertigen Prototypen herzustellen. Zudem können sich die Teams für die Implementierung von autonomen Funktionen in ihrem Fahrzeug entscheiden, was ihnen eine Teilnahme im neuen Formula-Student-Driverless Wettbewerb ermögdecide if it will have autonomous features, enabling them licht. Parallel zu der technischen Entwicklung müssen die to compete in the Formula Student Driverless competition. Teams einen tragfähigen Businessplan und ein Vermark-Along with these technical aspects, the teams must de-tungskonzept für eine Kleinserienfertigung des Fahrzeugs entwickeln. Zielgruppe ist der nicht-professionelle Wochenendrennfahrer. Daher muss der Rennwagen nicht nur ein beherrschbares Handling, sowie gute Beschleuhave manageable handling and possess good acceleration nigungs- und Bremswerte haben, sondern auch günstig and braking ability, but must also be inexpensive to buy in der Anschaffung und im Unterhalt sein. Wichtige Neand run. Thus, other important aspects of the vehicle that benaspekte des entwickelten Fahrzeuges sind Ästhetik, Ergonomie und die Verwendung von Serienbauteilen. Bewertet werden die Fahrzeugkonzepte von Experten aus der Automobil-, Motorsport- und Zulieferindustrie. In verschiedenen statischen und dynamischen Disziplinen können die Teams wichtige Punkte sammeln, die letztlich decide the overall ranking. The team with the best overall über die Gesamtplatzierung entscheiden. Den Sieg der scores from the combination of design, financial planning, Formula Student Germany erringt das Team mit dem besmarketing strategy and performance on the track will win ten Gesamtpaket aus Konstruktion, Finanzplanung, Verkaufsargumentation und Rennperformance.

# **Praxisnahe Erfahrung**

Die FSG bereichert die Lehrinhalte des Studiums um heschaftlichkeit und Marktrelevanz zu vernachlässigen. Die im Wettbewerb abgefragten Aspekte entsprechen den Anforderungen verschiedener Industriebereiche hinsichtlich Produktneuentwicklungen und sind daher nicht nur selbst entwickelten Lösungen zu verteidigen und gegenüber konkurrierenden Entwicklungen durchzusetzen.





# Formula Student Combustion and Formula Student Electric

Formula Student Germany is an engineering design competition for students. Students work together in teams to design and manufacture a prototype racecar, based on a hypothetical manufacturing contract. In order for the competing teams to be compared, their designs, plans and cars are judged by experts. Each team has the chance to win in total a maximum of 1,000 points over the course of static events, dynamic events and through proving the efficiency of their car. The team with the best overall combination of design, track performance, financial planning and marketing strategy will be a winner of FSG. In theory it is poswithout being the best in (or even being eliminated from) one or more events. Similarly, teams can win the top prize in one or more of the categories and still have no chance at an overall victory.

# Static Events

The Formula Student Germany competition is designed to introduce the participating students to the interdisciplinary approach of today's automotive industry. This not only includes technical understanding, but also economic and communication abilities such as presentation techniques or financial planning skills. This is why the three static events demand collaboration across the team in the areas of design and layout, construction, marketing and pricing of a product. They also require specialised expertise from different technical and financial courses of study. The teams can win up to sible to win the overall competition | 325 points of the possible 1000 in the three static events, and each individual event is weighted differently. A panel of experienced experts from the automobile, motorsport, and supply industries judge the performance of each

Die Formula Student Germany ist ein Konstruktionswettbewerb für Studenten, bei dem unter der Annahme eines fiktiven Konstruktionsauftrags der Prototyp eines Rennwagens entstehen soll. Um einen Vergleich der startenden Teams zu ermöglichen. werden die Konzepte, Planungen und Fahrzeuge von Experten bewertet. Insgesamt kann jedes Team in drei statischen und fünf dynamischen Disziplinen maximal 1000 Punkte erhalten. Den Gesamtsieg über die FSG erringt das Team mit dem besten Gesamtpaket aus Konstruktion, Rennperformance, Finanzplanung und Verkaufsargumentation. Prinzipiell kann also auch ein Team den Gesamtwettbewerb gewinnen, das in einer oder mehreren Disziplinen nicht zu den Besten zählt oder sogar ausscheidet. Auf der anderen Seite können durch dieses Bewertungssystem auch Teams einen Titel in einer oder mehreren Disziplinen erringen, obwohl sie keine Chance auf den Gesamtsieg haben.

# Engineering Design - 150 points

At the start of the engineering design competition, the students must hand in an eight-page technical description of their car. It must show both their design and how the design will be applied to their chosen construction. On the basis of this document, the members of the jury will evaluate the layout, technical design, construction and implementation of the production of the actual vehicle. Then, there will be a discussion where the teams are questioned by the judges. These discussions focus on clarifying technical details, exploring the thinking behind the chosen design, as well as the corresponding technical understanding of the students. The evaluation will not only assess the quality of the technical solution in question but also the reasons behind it.

# Statische Disziplinen

Der Formula-Student-Wettbewerb soll die teilnehmenden Studenten an die interdisziplinäre Arbeitsweise in der Industrie heranführen. Dazu zählen nicht nur technisches Verständnis, sondern auch wirtschaftliche und kommunikative Fähigkeiten, wie z. B. Präsentationstechniken oder Kompetenzen in der Finanzplanung. Daher wird in drei statischen Disziplinen sowohl die teamübergreifende Zusammenarbeit Vermarktung und Preisung eines Produktes als auch spezielles Fachwissen aus verschiedenen technischen und wirtschaftlichen Studiengängen gefördert und abgefragt. In den drei statischen Disziplinen können die Teams maximal 325 Punkte erreichen, wobei die Einzeldisziplinen unterschiedliche den die Leistungen der Teams durch sungen. eine Jury aus erfahrenen Experten der Automobil- und Zulieferindustrie sowie dem Motorsport.

# Engineering Design - 150 Punkte

Zu Beginn des Engineering Design Wettbewerbs reichen die Studenten eine achtseitige technische Beschreibung zu ihrem Fahrzeug ein, um das Konzept sowie die besondere Konstruktion darzustellen. Die Juroren begutachten auf Basis der Unterlagen das technische Konzept, die Auslegung, Konstruktionen sowie Umsetzung in der Fertigung am realen Fahrzeug. Die Teams müssen ihnen dabei bei Konzept, Auslegung, Konstruktion, zu allen Fragen in einer Diskussion Rede und Antwort stehen. In den Gesprächen geht es um die Abfrage der technischen Details, die Hintergründe für die Wahl eines Konzepts und das dazugehörige technische Verständnis In die Bewertung fließen also nicht nur die Qualität der vorliegenden technischen Lösungen ein, sondern auch Gewichtungen haben. Bewertet wer- die Gründe für die gewählten Lö-

# The cost judges go through the reports the teams have submitted, asking questions to ensure the team members can justify what they have presented

▶ Die Kostenjuroren gehen durch die von den Teams eingereichten Berichte und stellen Fragen, um sicherzustellen, dass die Team-mitglieder das Eingereichte begründen können.





- The design judges take a deep dive into the design decisions the teams have made for their vehicle.
- Die Design Juroren tauchen tief in die Design-Entscheidungsfindung der Teams für ihre Fahrzeuge ein.

# **Cost and Manufacturing**

# - 100 points

Cost is a decisive factor in the design of any product. In the cost analysis event, the teams must grapple with the calculative size of the vehicle, its components, and the necessary manufacturing steps and record all of this in a written cost report. The students must then answer questions from the judges relating to the cost report on their prototype. In addition to considering the thoroughness of the written report, the students' understanding of the manufacturing process and the total cost calculation will be assessed. The teams will also have to handle a real case scenario where they must react to product requirements being altered at short notice. The quality of their response to these changing circumstances will also form part of the overall point score.

# **Business Plan Presentation**

# - 75 points

Each team presents their business plan for the constructed prototype to a fictitious manufacturing company represented by judges. During a ten-minute presentation, the team must demonstrate why their design best fulfils the demands of their target group of amateur weekend racers and show how their design can be successfully marketed. The presentation will be followed by a five-minute discussion and question round with the judges. In this event the content, structure, and editing of the presentation, as well as the team's performance in delivering it, will be evaluated alongside their answers to the

# Total: 325 points

# **Cost and Manufacturing**

# · 100 Punkte

Die Kosten sind für Auslegung eines Produktes ein entscheidender Faktor. die Teams einem potentiellen Inve-Bei der Disziplin Cost Analysis müs- stor oder Partner, vertreten durch die sen sich die Teams mit den kalkulato- Juroren, ihren Geschäftsplan für den rischen Größen des Fahrzeugs, seiner gebauten Prototyp. Die Teams stellen Bauteile und der notwendigen Ferti- in einem zehnminütigen Vortrag dar, gungsschritte auseinandersetzen und diese schriftlich in einem Cost Report die Zielgruppe geeignet ist und eine festhalten. Zu den eingereichten Un- gewinnbringende Investition darstellt. terlagen müssen sich die Studenten mit ihrem Prototypen einer Diskussion tige Diskussions- und Fragerunde mit mit den Juroren stellen. Bewertet wer- den Juroren. Bei dieser Disziplin werden neben der Aufbereitung und Vollständigkeit des schriftlichen Reports auch das Verständnis der Fertigungs- Teams ebenso bewertet wie die Antprozesse sowie der Gesamtpreis.

Darüber hinaus müssen die Teams ein Real-Fall-Szenario bearbeiten, in dem Gesamtpunktzahl: 325 Punkte es darum geht, kurzfristig auf veränderte Anforderungen an das Produkt zu reagieren. Die Ergebnisse werden ebenfalls benotet und fließen in die Gesamtpunktzahl ein.

# **Business Plan Presentation**

#### - 75 Punkte

Mit ihrem Business Plan präsentieren weshalb ihr Konzept am besten für Der Präsentation folgt eine fünfminüden Inhalt, Aufbau und Aufbereitung des Vortrags sowie der Auftritt der worten auf die Fragen der Juroren.

▼ The teams must present their business plan to judges. The best plans will make it to the finals where they will be presented on the main stage.

 Die Teams müssen den Juroren ihren Businessplan präsentieren. Die Besten schaffen es bis ins Finale, wo sie auf der Hauptbühne präsentieren werden.





fastest lap times and the least number of penalties. etc. zusammensetzt.

▲ During the endurance race, the teams compete to get the aus den Rundenzeiten zzgl. der Strafzeiten für geworfene Hütchen

# Dynamic Events

The cars that the students design will not only be assessed when stationary. Their performance on the racetrack will also be put to the test. Each dynamic event tests different features of the vehicles. In addition to the maximum longitudinal and lateral acceleration, race performance, efficiency and endurance of the formula cars will be examined and evaluated. For the Acceleration, Skid Pad and Autocross events, each car starts with two drivers, each of whom is allowed two attempts. The best attempt is the one on which the car will be scored. A maximum of 675 points can be scored over the course of the four dynamic events and the efficiency event.

# Acceleration - 75 points

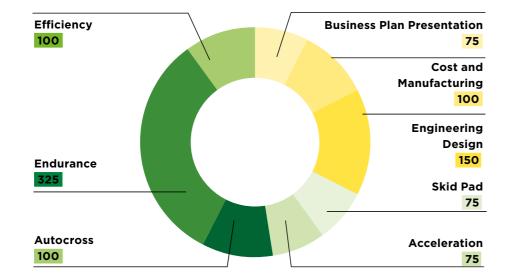
The vehicle's acceleration from a standing start is measured over a 75 metre straight. In addition to traction, the correct engine design is especially important, either in terms of greater power or for the highest possible torque. The fastest cars cross the line in less than four seconds and can reach speeds of over 100 km/h by the end of the stretch.

# Dynamische Diszplinen

Die von den Studenten konstruierten Fahrzeuge werden natürlich nicht nur im Stand bewertet. Sie müssen ihre Performance auch auf der Rennstrecke unter Beweis stellen. In jeder dynamischen Disziplin werden andere Eigenschaften des Fahrzeugs getestet. Neben der maximalen Längs- und Querbeschleunigung werden auch die Rennperformance, Effizienz und Halt- zeuge aus dem Stand gemessen. Hier barkeit der Formel-Rennwägen ermit- kommt es neben der Traktion vor telt und bewertet. Bei den Disziplinen Acceleration, Skid Pad und Autocross starten je Fahrzeug zwei Fahrer, die jeweils zwei Versuche haben. Gewer- an. Die schnellsten Fahrzeuge absoltet wird das beste mit dem Fahrzeug vieren diese Prüfung in einer Zeit unter erzielte Ergebnis. In den fünf dyna- vier Sekunden und erreichen am Ende mischen Disziplinen können maximal 675 Punkte erzielt werden.

# Acceleration - 75 Punkte

Auf einer 75 Meter langen Geraden wird die Beschleunigung der Fahrallem auf eine richtige Auslegung des Getriebes und eine möglichst hohe Leistung, bzw. ein hohes Drehmoment der Messstrecke Geschwindigkeiten von mehr als 100 km/h.



# ▶ Die Punkteverteilung für FSC und FSE ist identisch, da die Teams in 5 dynamischen und 3

statischen Events konkurrieren.

▶ The points for FSC and FSE have the same

events and 3 static events.

distribution as the teams compete in 5 dynamic

# Skid Pad - 75 points

During the Skid Pad event, the cars must drive a figure of 8 circuit lined with track cones, performing two laps of each circle. In each case, the second lap will be measured. The lap time gives a comparative value for the maximum possible lateral acceleration of the car. Most of the cars use aerodynamics to raise the contact pressure and thus, increase lateral acceleration. As with all the dynamic events, knocking over any of the cones results in a time penalty.

# Autocross - 100 points

In the autocross event, the cars traverse a kilometre-long track with straights, curves, and chicanes. A fast lap time is a sign of high driving dynamics, precise handling and good acceleration and braking ability. Once again, time penalties occur for those who knock over any cones. The autocross rankings decide the starting positions for the endurance competition that follows.

# Skid Pad - 75 Punkte

Beim Skid Pad durchfahren die Renn- Das Endurance-Rennen stellt mit fast wagen einen mit Pylonen begrenzten Parcours in Form einer Acht, Jeder Kreisring wird zweimal umrundet. Gemessen wird jeweils die zweite Runde. Die Rundenzeit gibt einen Vergleichswert für die maximal erzielbare Quer- zeuge unter Dauerbelastung beweisen. beschleunigung der Fahrzeuge. Bei Bei dieser Disziplin sind alle Eigenden meisten Fahrzeugen werden durch schaften der Prototypen wichtig, von den Einsatz aerodynamischer Hilfs- der Beschleunigung bis zum Handling mittel der Anpressdruck und damit und der Fahrdynamik. Zusätzlich ist die Querbeschleunigung erhöht. Das auch das Geschick der Fahrer gefragt, Umstoßen von Pylonen wird mit einer da die Strecke vor dem Rennen nur ab-Zeitstrafe belegt.

# Autocross - 100 Punkte

Bei der Disziplin Autocross fahren die Rennwagen über einen etwa ein Kilometer langen Kurs mit Geraden, Kurven und Schikanen. Eine schnelle ling sowie gute Beschleunigungs- und den umgestoßene Pylonen mit einer Zeitstrafe geahndet. Die Platzierung Endurance-Wettbewerb.

# Endurance - 325 Punkte

einem Drittel aller erreichbaren Punkte die Hauptdisziplin des Formula Student-Wettbewerbs dar. Über eine Renndistanz von 22 Kilometern müssen sich die konstruierten Rennfahrgeschritten werden darf (Course Walk). Jedes Team hat einen einzigen Versuch, wobei nach der Hälfte der Distanz ein Fahrerwechsel erfolgen muss. Es sind bis zu vier Fahrzeuge gleichzeitig auf der Strecke, wodurch es oft auch zu Überholvorgängen kommt. Diese werden von der Rennleitung veranlasst Rundenzeit ist ein Indikator für eine und finden in eigens dafür eingerichhohe Fahrdynamik, ein präzises Hand- teten Überholzonen statt, an denen die Strecke breiter ist. Das langsamere Bremseigenschaften. Auch hier wer- Fahrzeug bekommt dafür von den Streckenposten durch blaue Flaggen signalisiert, dass es einen schnelleren im Autocross entscheidet auch über Teilnehmer überholen lassen muss. Die die Startreihenfolge im nachfolgenden Teams erhalten nur dann Punkte, wenn sie höchstens ein Drittel langsamer waren als das schnellste Team. Auch hier werden Pylonenfehler durch Zeitstrafen geahndet.

# Endurance - 325 points

The endurance race represents almost sequently the most important event of the Formula Student Germany competition. The cars must demonstrate their capacity for endurance over a gruelling track distance of 22 km and all of the prototypes' features are crucial for the driver is also tested here, as they may only familiarise themselves with the track before the race by walking the length of the course (Course Walk). Each team gets just a single try and the drivers must be swapped at the halfway point. There can be up to four cars on the circuit at any given time and so overtaking manoeuvres must be performed frequently. Overtaking is signalled by a blue flag and is only permitted at specially marked sections of the track. A team will receive no points at the end if they are more than a third slower than the fastest team overall.

# Efficiency - 100 points

During the endurance race, fuel cona third of all available points and is con-sumption (FSC cars) or energy consumption (FSE cars) is precisely recorded. However, the absolute fuel and energy consumption is not what is Berechnung der Effizienz und der used to calculate the efficiency score, but rather the consumption relative to speed. This is to prevent teams from this event, from acceleration and han- driving particularly slowly in the en- lation zur Geschwindigkeit. Dadurch dling to driving dynamics. The skill of durance competition in order to score as highly as possible in the efficiency category.

# Total: 675 points

# Efficiency - 100 Punkte

Während des Endurance-Rennens wird der Kraftstoffverbrauch (FSC-Fahrzeuge), bzw. der Energieverbrauch (FSE-Fahrzeuge) gemessen. Bei der Punkte wird allerdings nicht der absolute Kraftstoff-/ Energieverbrauch gemessen, sondern der Verbrauch in Rewird verhindert, dass Teams während des Endurance-Wettbewerbs besonders langsam fahren, um eine möglichst hohe Punktzahl in der Efficiency-Disziplin zu erreichen.

Gesamtpunktzahl: 675 Punkte

During the AutoX. the FSE/FSE teams need to get the fastest lap time to win the race. This is also their qualifying for the Endurance race.

▼ Beim Autocross müssen die FSE / FSC-Teams die schnellste Rundenzeit erzielen, um das Sprint-Rennen zu gewinnen. Dies ist auch gleichzeitig ihre Qualifikationszeit für das Endurance-



- ▶ The points for the FSD competition are more heavily weighted to the static disciplines
- ▶ Bei der Punkteverteilung für FSD liegt mehr Gewicht auf den statischen Disziplinen.

# Formula Student **Driverless (FSD)**

As with the other two FSG competitions, the student racing teams at FSD compete with independently designed vehicles in dynamic and static disciplines. In contrast to FSC and FSE, the vehicles must cope with all dynamic disciplines completely autonomously with no driver sitting in the vehicle. In principle, however, "normal" driving with an FSD car is | The Static Disciplines will give the The Dynamic Disciplines make up the possible. The teams can freely select the type of drivetrain (electric or combustion), but must comply with the safety regulations of the respec- overall position. tive vehicle category.

In the case of autonomous vehicles, the development focus shifts away from pure driving dynamics to an optimal adaptation of the autonomous vehicle system to the respec- Engineering Design - 325 points tive driving situation. FSG takes this | The FSD Engineering Design event into account when judging the FSD ic and dynamic disciplines, as well as a redistribution of the maximum achievable points. By maintaining as many disciplines as possible and | the dynamic disciplines. maintaining the same maximum overall score, the comparability be- Total: 500 points tween all FSG competitions should at least be partially preserved.

# **Business Plan** Trackdrive Presentation 250 Cost and Manufacturing Efficiency 100 Acceleration 75 Engineering Skid Pad Design 325 75

# Static Disciplines

teams the opportunity to gain 50% of the points. These are critical for the teams in order to gain a competitive

# **Business Plan Presentation** - 75 points and

Cost Analysis - 100 points are identical to FSC and FCE.

is considered more valuable for the teams. This requires different stat- teams as far as points. Not only will the design of the vehicle be judged, like it is in FSC and FSE, but the teams will also be judged on vehicle data from

# Dynamic Disciplines

remaining 50% of the points. In Formula Student Driverless, the Trackdrive replaces the Endurance and AutoX events.

# Acceleration - 75 points and Skid Pad - 75 points

will also be held for FSD as described above, but as a driverless event.

# Trackdrive - 250 points

The Autonomous Vehicles will race in a Track Race over 10 laps on a 300 to 500 metre long coned course.

# Efficiency - 100 points

As in the case of the FSC and FSE, consumption-related points for the efficiency are also added.

Total: 500 points

▶ The Remote Emergency Stop (RES) can be pressed at anytime when the Driverless race cars are running on track. The race car will stop

> ▶ Wenn sich die fahrerlosen Fahrzeuge auf der Strecke befinden, kann jederzeit ein Ferngesteuerter Not-Aus-Schalter (RES) aktiviert werden. Der Rennwagen wird anhalten



During the TrackDrive event, there is no pilot sitting in the race car.

> ► Während des TrackDrive-Events sitzt kein Fahrer im Rennwagen.

# Formula Student **Driverless (FSD)**

Wie bei den anderen beiden FSG-Wettbewerben konkurrieren die Teams bei FSD mit eigens entwickelten Fahrzeugen in den dynamischen und statischen Disziplinen. Im Gegensatz zu FSC und FSE müssen die Fahrzeuge alle dynamischen Disziplinen komplett autonom bewältigen - ohne Fahrer im Fahrzeug. Prinzipiell ist jedoch "normales" Fahren mit In den statischen Disziplinen können In den dynamischen Disziplinen köneinem FSD-Auto durchaus möglich. Bei der Wahl der Art des Antriebsstrangs (elektrisch oder Verbrenner) sind die Teams völlig frei. Die Sicherheitsvorschriften der jeweiligen Fahrzeugklasse müssen jedoch eingehalten werden.

Bei autonomen Fahrzeugen ver- sind identisch zu FSC und FCE. schiebt sich der Entwicklungsschwerpunkt von reiner Fahrdynamik hin zu einer optimalen Auslegung der autonomen Fahrzeugsysteme auf die jeweilige Fahrsituation. Dies berücksichtigt FSG bei der Beurteilung der FSD-Teams, was Unterschiede bei den statischen und dynamischen Disziplinen sowie eine Umverteilung der erreichbaren Punkte pro Disziplin erfordert. Durch die Beibehaltung möglichst vieler Disziplinen im Ver- Gesamtpunktzahl: 500 points gleich zu FSC und FSE sowie der selben maximal erreichbaren Gesamtpunktzahl bleibt die Vergleichbarkeit aller FSG-Wettbewerbe zumindest teilweise erhalten.

# Static Disciplines

die Teams 50 % der Punkte sammeln. erreichen.

# **Business Plan Presentation** - 75 points and Cost Analysis - 100 points

Engineering Design - 325 points)

Das FSD Engineering Design erhält in Fahrer. Bezug auf die erreichbaren Punkte ein größeres Gewicht und gewinnt damit an Bedeutung für die FSD Teams. Im Gegensatz zu FSC und FSE wird bei der Bewertung des Ingenieurswissens ein deutlicher Fokus auf die auto- fahren. nomen Systeme gelegt.

# Dynamic Disciplines

nen die Teams demnach die anderen Diese Disziplinen sind also entschei- 50 % der Punkte einfahren. Bei der dend, um eine gute Gesamtposition zu Formula Student Driverless ersetzt der so genannte "Track Drive" das Endurance-Rennen und die Disziplin Autocross.

# Acceleration - 75 points and Skid Pad - 75 points

werden wie oben beschrieben ebenfalls für FSD beibehalten, jedoch ohne

# TrackRace - 250 points

Die autonomen Fahrzeuge werden in einem Track Race über 10 Runden auf einem 300 bis 500 Meter langen Kurs

# Efficiency - 100 points

Wie bei FSC und FSE werden verbrauchsbezogene Punkte für die Effizienz vergeben.

Gesamtpunktzahl: 500 Punkte

Safety Regulations

Sicherheit und Regeln

A series of safety measures and regulations must be observed for every prototype car competing. This is to ensure safety and a levelled playing field between the teams. It is important as all teams are at different levels, whether it is be different qualifications in terms of experience, personal ability or financial resources. Every car must pass Scrutineering in order to be allowed to participate in the dynamic categories. Teams are awarded various stickers for each safety check they pass. They must be placed on the front of their cars to show it has passed a particular test. For the FSC and FSE series, there are also system-specific differences in terms of operation safety that have to be followed during scrutineering.

Da alle Fahrzeuge Prototypen sind, müssen die Teams eine Reihe von Sicherheitsmaßnahmen und Regeln einhalten. Auf diese Weise wird zudem eine Chancengleichheit zwischen den Teams gewährt, die mit unterschiedlichen Voraussetzungen in Bezug auf Erfahrung, personelle Kapazitäten und finanzielle Ressourcen an den Start gehen. Das erfolgreiche Absolvieren des sogenannten Scrutineerings ist die Grundvoraussetzung für die Zulassung eines Fahrzeugs zu den dynamischen Disziplinen. Für jeden erfolgreich absolvierten Check erhalten die Teams einen Aufkleber, der auf der Fahrzeugnase angebracht werden muss. Bei FSC und FSE gibt es Unterschiede bei der Betriebssicherheit, die beim Scrutineering berücksichtigt werden müssen.



#### Electrical inspection

Flektrische Ahnahme

#### Accumulator (FSE)

The 'Accumulator' is a technical term for the battery. It is built up of battery cells that can be connected in various series and parallel configurations. For the electrically powered Formula Student cars, the 'Accumulator' is the sole source of energy that enables the cars to drive. This is critical to safety if it is incorrectly designed or built. To protect for this, it is checked before the teams may compete in the dynamic events. Overheating of the cells can lead to fire. A temperature-logging device is installed by the FSG scrutineers, to ensure that the monitoring of the cell temperature is accurate. The batteries are sealed once the inspection has been carried out. The teams must transport their 'Accumulator' on a specially designed trolley so that it can be moved away should there be any risk of the cells overheating.



# Batterie (FSE)

Der Akkumulator, kurz Akku, ist der technische Fachbegriff für die Fahrzeugbatterie. Diese besteht aus einer Vielzahl an Zellen, die in Reihe oder parallel geschalten sind. Für elektrische Formula Student Fahrzeuge ist der Akku die einzige Energiequelle, die das Fahrzeug antreibt. Daher ist der korrekte Aufbau des Bauteils essentiell für die Fahrzeugsicherheit. Um eventuelle Fehlfunktionen und Ausfälle zu vermeiden, werden die Akkus vor den dynamischen Disziplinen genau geprüft. Bei Überhitzung der Zellen kann ein Brand entstehen, weswegen für die genaue Überwachung der Zelltemperatur durch die FSG Scrutineers Temperatursensoren angebracht werden. Die Teams sind zudem dazu verpflichtet, ihre Akkus auf speziellen Wägen fortzubewegen, um im Falle einer Überhitzung schnell abtransportiert werden zu können.



# **Electrical Scrutineering (only FSE)**

During electrical scrutineering, the electrical safety of the electric car is guired by the regulations are checked Tractive System Active Light, which displays the status of the high voltage have been laid correctly mechanically their vehicle within five seconds. and whether the high voltage energy storage device is assembled according to regulation.

# Tech and Safety (FSC and FSE)

For this inspection, all the components and accessories of the racecar that are considered relevant to safety according to the regulations are checked. tested. That means all systems re- These include the framework, wheel suspension, steering, braking, rims, in regard to their functional capacity. and tires. Other details, such as the For example, system checks include layout of the fuel lines, the fixture of the insulation-monitoring device, cor- the air intake system, the observance rect operation of the signal light (the of appropriate cockpit size and the correct functioning of the kill switch are all checked. In addition to this, system) and the sound that indicates all drivers must show that when in a that the vehicle is ready to race. In ready-to-race condition, i.e., strapped addition, general safety aspects are in to the driving seat wearing their full checked, such as whether the wires racing suit and helmet, they can exit



# Electrical Scrutineering (nur FSE)

Während des Electrical Scrutineerings wird die elektrische Sicherheit der Elektrofahrzeuge überprüft, d.h. alle durch das Regelwerk vorgegeprüften Systemen gehören u.a. die Funktionsweise des Signallichts (Tractive System Active Light, das die Akaber auch allgemeine Sicherheitsasforme Einbau des Hochvolt-Energie- können. speichers überprüft.

# Tech and Safety (FSC und FSE)

Bei dieser Abnahme werden alle sicherheitsrelevanten Bau- und Zubehörteile des Rennwagens, die durch das Regelwerk vorgeschrieben werschriebenen Systeme werden auf ihre den, geprüft. Dazu gehören unter Funktionsfähigkeit getestet. Zu den anderem die Rahmenstruktur, die Radaufhängung, Lenkung, Bremsen, Isolationsüberwachung, die korrekte Felgen und Reifen. Auch Details wie die Verlegung der Kraftstoffleitungen, die Befestigung des Ansaugsystems, tivität des Hochvoltsystems anzeigt) die Einhaltung der Cockpitgröße oder und der Signalton, der die Fahrbe- die korrekte Funktionsweise der Notreitschaft des Fahrzeugs signalisiert schalter werden geprüft. Zusätzlich (Ready To Drive Sound). Es werden müssen alle Fahrer zeigen, dass sie in einem fahrfertigen Zustand, d.h. voll pekte wie z B. mechanisch einwandfrei eingekleidet und angegurtet, das Auto verlegte Leitungen oder der regelkon- innerhalb von fünf Sekunden verlassen

# Tilt Table (FSC and FSE)

The tilt table test checks whether any operating fluids are leaking and roll- Noise Test (only FSC) over protection regulations are met. The noise test checks that the car com-The car must be brought to the test in plies with the provisions for the aca ready to race condition, with all flu- ceptable noise level. In order to measids and a full tank of petrol. The driver ure the volume, the engine is run in is strapped in and the car is set at an neutral at a rotation speed. The speed angle of 45 degrees. No fuel or other depends on the type of engine. In neufluids are allowed to leak out at this an- tral, the noise level must not exceed gle. After this, the angle is increased 100 dBC or be any greater than 110 to 60 degrees, which corresponds to dBC at a specified rotation speed. a lateral acceleration force of 1.7g. The race car only passes this test if the upper wheels remain on the floor.

# Rain Test (only FSE)

Rain can lead to critical situations for electric cars. In order to be allowed to operate during rainfall with no reservations, the FSE cars must undergo an artificial rain shower. During the artificial rainfall, the car's high voltage system is activated and the appropriate components can be checked to see if they are sufficiently insulated and protected from water.



die Neigung auf 60 Grad erhöht, was

einer Querbeschleunigung von 1,7 g

# Der Noise Test überprüft, ob das Fahr-

zeug den Vorschriften für die Einhal-Tilt Table (FSC und FSE) tung des Lärmpegels entspricht. Dazu Beim Tilt Table Test wird überprüft, ob wird bei laufendem Motor im Leerlauf, keine Betriebsflüssigkeiten austreten bei einer durch die Bauart des Motors und die Regularien zum Überrollschutz vorgeschriebenen Drehzahl, die Lauterfüllt werden. Die Fahrzeuge müssen stärke gemessen. Der Lärmpegel darf startklar, mit allen Flüssigkeiten und dabei im Leerlauf nicht höher als 100 vollgetankt, zum Test gebracht werdBC und nicht höher als 110dBC bei den. Das Fahrzeug mit angeschnalltem der vorgeschriebenen Drehzahl sein. Fahrer wird bis zu einem Winkel von 45 Grad geneigt. Bei diesem Winkel dürfen kein Kraftstoff oder andere Flüssigkeiten austreten. Danach wird

Noise Test (nur FSC)



# Rain Test (nur FSE)

Regen kann bei Elektrofahrzeugen zu kritischen Situationen führen. Damit die FSE-Fahrzeuge auch bei Niederschlägen vorbehaltlos fahren können, müssen sie sich einem künstlichen Regenschauer unterziehen. Während der künstlichen Beregnung des Fahrzeuges wird bei aktiviertem Hochvoltsystem kontrolliert, ob die verwendeten Komponenten ausreichend isoliert und gegen Regen geschützt sind.





# **Brake Test (FSC and FSE)**

The brake test checks whether a braking system is able to lock all four wheels of the car simultaneously and bring the vehicle to a controlled stop. However, since the FSE cars can also use their electric motor braking sys- FSD cars to pass the brake test. tem, if the driver is operating an electric vehicle, in addition they must deactivate the high voltage system after accelerating and then come to a complete stop with all four wheels locked in order to demonstrate that the mechanical braking system functions properly in the case of a fault in the high voltage system.

# Brake Test (FSD)

Formula Student Driverless cars are equipped with an Emergency Brake System (EBS). This is actuated via the Remote Emergency System (EBS). This must be tested in order for the



# **Brake Test (FSC und FSE)**

Der Bremstest dient zur Überprüfung, ob das Bremssystem in der Lage ist, zeitig zu blockieren und dadurch das Fahrzeug zu einem kontrollierten Stillstand zu bringen. Die FSE-Fahrzeuge können den elektrischen Antrieb auch zum Bremsen verwenden. Um eine einwandfreie Funktion des mechanischen Bremssystems bei einem Fehler im Hochspannungssystem nachzuweisen, muss der Fahrer nach dem Beschleunigen das Hochvoltsystem deaktivieren und anschließend mit vier blockierenden Rädern zum Stehen kommen.

# **Brake Test (FSD)**

Formula Student Driverless Fahrzeuge sind mit einem Notfallbremssystem alle vier Räder des Fahrzeugs gleich- (EBS) ausgestattet, welches durch eine Fernbedienung aktiviert werden kann. Um den FSD Brake Test zu bestehen, muss die Funktionsfähigkeit des EBS per Fernbedienung nachge-

# **Driverless Inspection (FSD only)**

In order to guarantee the safety of the autonomous vehicles in the operation and handling for all parties concerned, the team must fulfill some special requirements. Each vehicle must be equipped with a so-called RES (Remote Emergency System), which fulfills two functions. By means of this remote control, the required emergency brake system (EBS) can be triggered and the vehicle can be stopped in emergency situations. At the same time, the RES control system enables the "Go" signal to be sent to the vehicle at the start of the dynamic disciplines. Furthermore, all FSD vehicles are equipped with different coloured signal lamps, which indicate the respective operating states of the vehicle. In autonomous mode, a yellow signal is illuminated, whilst a blue light indicates the status of the RES. These systems must be tested during the Driverless Inspection.



# **Driverless Inspection (nur FSD)**

Um die Sicherheit der autonomen Fahrzeuge bei der Bedienung und Handhabung für alle Beteiligten zu gewährleisten, muss das Team einige besondere Anforderungen erfüllen. Jedes Fahrzeug muss mit einem sogenannten RES (Remote Emergency System) ausgestattet sein, das zwei Funktionen erfüllt. Mit dieser Fernbedienung kann das erforderliche Notbremssystem (EBS) ausgelöst und das Fahrzeug in Notsituationen angehalten werden. Gleichzeitig ermöglicht das RES-Steuerungssystem, dass das "Go" -Signal zu Beginn der dynamischen Disziplinen an das Fahrzeug gesendet wird. Darüber hinaus sind alle FSD-Fahrzeuge mit verschiedenfarbigen Signallampen ausgestattet, die die jeweiligen Betriebszustände des Fahrzeugs anzeigen. Im autonomen Modus leuchtet ein gelbes Signal, während ein blaues Licht den Status des RES anzeigt. Diese Systeme müssen während der Driverless Scrutineering getestet werden.

#### Adherence to the Rules

and, from a technical point of view, be tion until the fault has been repaired. safe at all times, even after passing Cars are also inspected again following scrutineering. The authorised technithe endurance race in order to exclude cal experts or the race stewards can the possibility of a violation during the remove a car from the competition race. This is why the cars are placed in at any time in the case of a breach of a parc fermé after the endurance comregulation or safety requirements, for petition, and the team members are example, if a car is leaking fluids, is too loud, or if the insulation is not up to standard.

Vehicles must conform to regulations The car cannot return to the competinot permitted to touch them until all the inspections have been successfully performed.

# Geltungsbereich

Die Fahrzeuge müssen auch nach be- Mangel behoben wurde. Nach dem Enstandenem Scrutineering zu jeder Zeit regelkonform und sicherheitstechnisch unbedenklich sein. Die offiziellen rend des Rennens ausschließen zu köntechnischen Sachverständigen oder nen. Hierfür werden die Fahrzeuge in die Rennleitung können Fahrzeuge bei einem "Parc-Fermé" abgestellt und düreinem Verstoß gegen das Reglement fen von den Teammitgliedern solange oder die Sicherheitsanforderungen je- nicht mehr berührt werden, bis die letzderzeit aus dem Wettbewerb nehmen, te Abnahme erfolgt ist. z.B. wenn Flüssigkeiten austreten, das Fahrzeug zu laut oder die elektrische Isolation nicht gewährleistet ist. Die Fahrzeuge können erst dann wieder am Wettbewerb teilnehmen, wenn der

durance-Rennen werden die Fahrzeuge erneut geprüft, um Regelverstöße wäh-

> Technical inspection Technische Abnahme



# It is critical for safety that the students understand the meaning of the different flags.

Aus Sicherheitsgründen ist es essentiell, dass die Studierenden die Bedeutung der verschiedenen Flaggen kennen.



# **▶ Flags**

During the dynamic events, flags are used to communicate Farben und Muster haben unterschiedliche Bedeutungen. with the drivers. The various colours and patterns have Alle Fahrer müssen die Flaggen kennen und beachten, different meanings, and all drivers must understand and wenn sie diese während des Wettbewerbs gezeigt bekomobey any flag signal they receive during the competition. men. Verstöße gegen geschwenkte Flaggen können mit Infringements of flag signals can be penalised with various verschiedenen Sanktionen geahndet werden, die von Zeitpenalties, ranging from time penalties to disqualification.

# Flaggen

Bei den dynamischen Prüfungen werden zur Kommunikation mit den Fahrern Flaggen eingesetzt. Die verschiedenen strafen bis zur Disqualifikation reichen können.

Halte die Strecke frei.



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



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



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

Verlass die Strecke!



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!



Pull into the passing zone to be passed by a faster competitor!

Fahr in die Überholzone, damit ein schnelleres Fahrzeug passieren kann!



tion. 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

Something has happened beyond the flag sta-

nicht vorbei ohne Anweisung der Streckenposten. Flagge gehalten: Gefahr! Fahr langsam, sei bereit zum Ausweichen. Flagge geschwenkt: Große Gefahr! Fahr langsam, Ausweichen wird erforderlich sein. Sei bereit anzuhalten.



concerning an incident that may cause a time penalty! Fahr in die Kontrollzone zur Diskussion

Pull into the penalty box for discussion

eines Vorfalls! Ggf. Zeitstrafe!



Pull into the penalty box for a mechanical inspection of your car!

Fahr in die Kontrollzone für eine Untersuchung des Fahrzeugs!



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**Autonomous Racing** 

Workshop

In 2017 only three teams participated in the new driverless 2017 sind bei der Formula Student Germany in Hockendiscipline at Formula Student Germany in Hockenheim. heim in der neuen Driverless Disziplin drei Teams an den However, Formula Student is an event that is mainly char- Rennstart gegangen. Allerdings ist Formula Student ein acterized by the competition itself - that's what the "e-gni- Wettbewerb, der von der Konkurrenz lebt - das dachte sich tion" team from Hamburg thought when they decided to das Team "e-gnition" aus Hamburg und entschied sich kurprovide a creative environment for an intensive exchange zerhand dafür, eine kreative Umgebung für einen intensiven between the Formula Student Driverless Teams. The re- Austausch unter den Formula Student Driverless Teams zu sult was the first "Autonomous Racing Workshop", which bieten. Heraus kam dabei der erste "Autonomous Racing took place from 23rd to 25th February 2018 at the Techni- Workshop", der vom 23.-25. Februar 2018 an der TU Hamcal University of Hamburg. It consisted of two days full of burg stattfand: Zwei diskussionsreiche Workshop-Tage, 35 discussions, 35 exciting topics and 110 participants from 15 spannende Themen und 110 Teilnehmer aus 15 Formula Stu-Formula Student Driverless Teams.

The aim of the workshop was to create a solid platform for Ziel des Workshops war es, eine solide Plattform für den incontent exchange between the teams. Focus was not given haltsstarken Austausch der Teams zu schaffen. Dabei stand on discussing finalised concepts, but on the exchange of nicht die Diskussion über ausgereifte Konzepte im Fokus ideas and open talks about whether their ideas and innova- für die Studierenden sollten erste Ideen im Mittelpunkt stetions are functional and feasible.

dent Driverless Teams.

hen sowie das offene Gespräch darüber, ob die angebrachten Ideen und Impulse funktional und realisierbar sind.



The agenda of the workshop was consciously held open thus 
Der bewusst offen gestaltete Workshopcharakter bot den giving the participants the opportunity either to participate on a topic as an expert or alternatively as someone, there to speaking up about their team concerns.

At the workshop, the competition was of secondary importance; it was about increasing the overall level for all Formula Student Driverless teams.

"Formula Student is a competition - and will continue to be so in the future. But if all the teams get a few more ideas to improve themselves and to become faster in the end, the competition will be even more exciting", said Nils Albrecht. The team from Hamburg gave great importance to the fact that

the workshop is an event from teams for teams. The topics von Teams für Teams handelt. Die Themen der Studieren-FSG competition - they can have a direct exchange and help each other.

alternativ als Lernender teilzunehmen. Die Studierenden learn. As part of the registration, the students could offer to hatten die Möglichkeit, im Rahmen ihrer Registrierung ein lecture on a topic, however, this did not prevent them from Thema anzubieten, über das man referieren wollte - aber auch vor Ort bestand noch die Chance, Teambelange und Themenschwerpunkte einzubringen.

> "If there are no competitors, you will never perform at the technical limit - it is just not necessary."

Nils Albrecht. Head of Driverless 2017, team "e-gnition" from Hamburg

bewerbsgedanke im Vordergrund. In erster Linie ging es darum, gesamthaft das Niveau für alle Formula Student Driverless Teams zu steigern, "Formula Student ist ein Wettbewerb - und das bleibt auch so. Aber wenn man allen Teams ein paar mehr Ideen mitgibt und diese gemeinsam Inhalte erarbeiten lässt, die dabei unterstützen, dass alle besser und schneller werden, dann wird der Wettbewerb noch viel spannender", so Nils Albrecht. Dabei hat das Team aus Hamburg Wert darauf gelegt, dass es sich bei dem Workshop um ein Event

Für die Teams stand nicht der Wett-

of the students and the discussion of solutions, as well as den und das Besprechen von Lösungswegen stand im Vornetworking, were the focus. Thanks to the workshop, the dergrund, ebenso wie das Netzwerken. Die Teams kennen teams will know each other in person even before the next sich dank des Workshops bereits vor dem nächsten FSG

Teilnehmern die Chance, an einem Thema als Experte oder

Technical lectures by the companies Ibeo and NXP also of- Wettbewerb personlich - man kann in den direkten Ausfered the students the opportunity to "think outside the tausch gehen und sich gegenseitig helfen.

The organizing team around Nils Albrecht looked back sat- "über den Tellerrand hinaus zu blicken". isfied about the output of workshop and would like to pro-

vide the relaxed workshop atmosphere for the Formula Student Driverless Teams again next winter. "Most of the participants were enthusiastic about the concept and were able to benefit a lot".

This success story shows that it is the team spirit that makes the FSG competition very special and unique. Competing with each other requires pushing each other to the limit in order to demand the ultimate challenge. Because

Technische Fachvorträge von den Unternehmen Ibeo und

NXP boten den Studierenden zusätzlich die Möglichkeit

Das Organisationsteam rund um Nils Albrecht blickt auf einen zufriedenstellenden Workshop zurück und "Wenn es im Wettkampf keine möchte auch im kommenden Winter erneut eine entspannte Work-Konkurrenz gibt, wird man nie shop-Atmosphäre für die Formula die Leistung bringen, die das

Nils Albrecht. Leitung Driverless 2017, Team "e-gnition" aus Hamburg

ist einfach nicht notwendig."

Student Driverless Teams bereitsteltechnische Limit wiederspiegelt - es len. "Die meisten Teilnehmer waren vom Konzept ziemlich begeistert und haben viel aus der Sache mitgenommen". Diese Erfolgsgeschichte zeigt, dass es der Teamgeist ist, der den FSG-Wettbewerb zu etwas ganz be-

sonderem macht. Im Wettbewerb

zueinander stehen, heißt auch, sich

gegenseitig zu fördern - um sich

as Nils Albrecht said: "Competition is encouraging the busi- schlussendlich zu fordern. Denn wie Nils Albrecht so schön gesagt hat: "Konkurrenz belebt das Geschäft"



# **Awards** 2018

Results:









|             | Formula Student                                       | Combustion | Electric | Driverless |
|-------------|---|------------|----------|------------|
| -           | 1st Place Overall                                     | SUN        | SUN      | SUN        |
| OVERALL     | 2nd Place Overall                                     | SUN        | SUN      | SUN        |
| 0           | 3rd Place Overall                                     | SUN        | SUN      | SUN        |
|             | Acceleration Winner                                   | SAT        | SAT      | SAT        |
|             | Autocross Winner                                      | SAT        | SAT      | -          |
| DYNAMICS    | Endurance Winner                                      | SUN        | SUN      | -          |
| DYNA        | Most Fuel/Energy Efficient Car                        | SUN        | SUN      | SAT        |
|             | Skid Pad Winner                                       | SAT        | SAT      | SAT        |
|             | TrackDrive Winner                                     | _          | -        | SAT        |
| S           | Business Plan Presentation Winner                     | SAT        | SAT      | SAT        |
| STATICS     | Cost and Manufacturing Winner                         | SAT        | SAT      | SAT        |
| 0,          | Engineering Design Winner                             | SAT        | SAT      | SAT        |
|             | FSC MTU Most Innovative Powertrain System Award       | SAT        | -        | -          |
| ARDS        | FSE Daimler e-Drive Technology Award                  | -          | SAT      | -          |
| AWAR        | FSG BASF Best Use of Fiber Reinforced Plastics Award  | SAT        |          | -          |
| SPECIAL AWA | FSG Kube Best IAD Award                               | SAT        |          | -          |
| SB          | FSG Siemens Digital Twin Engineering Excellence Award | SAT        |          | -          |
|             | FSG Sportsmanship Award                               |            |          |            |

STATUS/STAND: 20.07.2018





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| Registration for 18 DV + 2 EV Teams, ASR, ESO, Drivers | 14   | Ticket Centre   |
|--|--|---|
| Entrance for 18 DV + 2 EV Team Vehicles + 7 Members    | 8  | Pits  |
| Charging Tent available                                | 2  | Charging Tent   |
| DV & EV Pits available                                 | 8  | Pits  |
| DV & EV Technical Inspections (A, D, E, M & P)         | 2 + 8  | Charging Tent, Pits, Venue  |
| Registration for 38 EV Teams, ESO & Drivers            | 14   | Ticket Centre   |
| Entrance for 38 EV Team Vehicles + 7 Members           | 8  | Pits  |
|  | Charging Tent available  DV & EV Pits available  DV & EV Technical Inspections (A, D, E, M & P)  Registration for 38 EV Teams, ESO & Drivers | Entrance for 18 DV + 2 EV Team Vehicles + 7 Members  Charging Tent available  DV & EV Pits available  EV & EV Technical Inspections (A, D, E, M & P)  Registration for 38 EV Teams, ESO & Drivers  14 |

| lue, /        | tii vi August  |  |
|---------------|--|--|
| 07:00 - 22:00 | Charging Tent  | 2 Charging Tent                        |
| 07:00 - 24:00 | DV & EV Pits available   | 8 Pits                                 |
| 07:45 - 12:30 | Event Control  | 5 Event Control                        |
| 08:00 - 12:15 | DV & EV Technical Inspections (A, D, E, M & P)                   | 2+3 Charging Tent, Dynamic Area, Venue |
| 13:00 - 19:00 | DV Engine Test (on request)                                      | 3 Dynamic Area                         |
| 13:00 - 19:00 | Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake | 2+3 Charging Tent, Dynamic Area, Venue |
| 14:00 - 16:30 | Registration for 60 CV Teams                                     | 14 Ticket Centre                       |
| 14:00 - 19:00 | Event Control  | 5 Event Control                        |
| 15:30 - 19:00 | Entrance for all CV Team Vehicles + All Members                  | Venue                                  |
| 15:30 - 24:00 | All Pits & Recreation Tent available                             | 8+10 Pits, Recreation Tent             |
| 16:00 - 19:00 | CV Driver Registration   | 5 Event Control                        |
| 21:00 - 22:00 | Team Welcome   | 7 Marquee above pits                   |

| Wed,          | Bth of August  |  |
|---------------|--|--|
| 06:00 - 22:00 | Charging Tent  | 2 Charging Tent                        |
| 06:00 - 24:00 | Pits & Recreation Tent available                                 | 8 + 10 Pits, Recreation Tent           |
| 07:45 - 12:30 | Event Control  | 5 Event Control                        |
| 07:45 - 18:00 | Ticket Centre  | 14 Ticket Centre                       |
| 08:00 - 13:00 | Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake | 2+3 Charging Tent, Dynamic Area, Venue |
| 09:00 - 19:00 | DV Emergency Brake System (EBS) Test                             | 12 Start/Finish Line                   |
| 09:00 - 19:00 | Engine Test  | 4 Engine Test Area                     |
| 10:45 - 18:00 | FSG Academy On Site  | 11 South Stand                         |
| 11:00 - 17:30 | DV & EV Business Plan Presentation                               | 1+9 BW Tower, Ravenol Tower            |
| 11:00 - 18:00 | CV Special Awards  | 6 FSG Forum                            |
| 11:00 - 18:50 | DV & EV Cost Analysis, Engineering Design                        | 7 Marquee above pits                   |
| 13:00 - 20:00 | DV & EV Team Photos  | 7 Marquee above pits                   |
| 14:00 - 19:00 | Event Control  | 5 Event Control                        |
| 14:00 - 19:00 | Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake | 2+3 Charging Tent, Dynamic Area, Venue |
| 20:00 - 21:00 | DV & EV Business Plan Presentation Finals                        | 7 Marquee above pits                   |

STATUS/STAND: 20.07.2018 SCHEDULE 2018 33

# NOW HIRING

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| Thu, 9        | th of August   |  |
|---------------|--|--|
| 06:00 - 18:30 | Recreation Tent available  | 10 Recreation Tent                     |
| 06:00 - 22:00 | Charging Tent  | 2 Charging Tent                        |
| 06:00 - 24:00 | Pits available   | 8 Pits                                 |
| 07:45 - 12:30 | Event Control  | 5 Event Control                        |
| 07:45 - 18:00 | Ticket Centre  | 14 Ticket Centre                       |
| 08:00 - 13:00 | Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake | 2+3 Charging Tent, Dynamic Area, Venue |
| 09:00 - 16:00 | DV Emergency Brake System (EBS) Test                             | 12 Start/Finish Line                   |
| 09:00 - 16:15 | FSG Academy On Site  | 11 South Stand                         |
| 09:00 - 19:00 | Engine Test  | 4 Engine Test Area                     |
| 09:00 - 20:00 | CV, EV, DV Practice Track  | 3 Dynamic Area                         |
| 09:15 - 16:35 | CV Cost Analysis, CV Engineering Design                          | 7 Marquee above pits                   |
| 09:30 - 16:00 | CV Business Plan Presentation                                    | 1+9 BW Tower, Ravenol Tower            |
| 09:30 - 17:15 | EV Special Awards  | 6 FSG Forum                            |
| 11:15 - 17:30 | CV Team Photos   | 7 Marquee above pits                   |
| 14:00 - 19:00 | Event Control  | 5 Event Control                        |
| 14:00 - 19:00 | Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake | 2+3 Charging Tent, Dynamic Area, Venue |
| 17:15 - 18:15 | Staging for Panoramic Photograph                                 | 12 Start/Finish Line                   |
| 19:15 - 21:45 | DV Engineering Design Finals (not public)                        | 10 Recreation Tent                     |
| 19:15 - 21:45 | EV Engineering Design Finals (not public)                        | 6 FSG Forum                            |
| 19:30 - 20:30 | CV Business Plan Presentation Finals                             | 7 Marquee above pits                   |
|               |  |  |

# Fri, 10th of August

|               | il Di August  |        |                                    |
|---------------|---|--------|------------------------------------|
| 06:00 - 22:00 | Charging Tent   | 2      | Charging Tent                      |
| 06:00 - 24:00 | Pits & Recreation Tent available                                    | 8 + 10 | Pits, Recreation Tent              |
| 07:15 - 12:30 | Event Control   | 5      | Event Control                      |
| 07:15 - 18:00 | Ticket Centre   | 14     | Ticket Centre                      |
| 07:30 - 07:50 | Team Briefing   | 7      | Marquee above pits                 |
| 08:00 - 12:00 | Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake (on request) | 2 + 3  | Charging Tent, Dynamic Area, Venue |
| 08:30 - 12:30 | CV & EV Practice Track  | 3      | Dynamic Area                       |
| 08:30 - 14:30 | CV & EV Skid Pad  | 3      | Dynamic Area                       |
| 08:30 - 18:30 | CV & EV Small Practice Track / Engine Test                          | 3      | Dynamic Area                       |
| 09:00 - 10:00 | Design Review   | 7      | Marquee above pits                 |
| 09:00 - 18:00 | FSG Academy On Site   | 11     | South Stand                        |
| 09:30 - 13:30 | DV Acceleration   | 12     | Start/Finish Line                  |
| 10:00 - 12:00 | Design Feedback: Judges available                                   | 7      | Marquee above pits                 |
| 11:00 - 11:45 | Press Guided Tour   | 1      | Assembly at entrance BW Tower      |
| 12:00 - 12:45 | Press Conference  | 1      | BW Tower, 4.floor                  |
| 12:30 - 14:00 | DV Practice Track   | 3      | Dynamic Area                       |
| 13:00 - 14:00 | VIP Reception   | 1      | BW Tower, 5.floor                  |
| 13:00 - 18:00 | Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake (on request) | 2 + 3  | Charging Tent, Dynamic Area, Venue |
| 14:00 - 18:30 | CV & EV Practice Track  | 3      | Dynamic Area                       |
| 14:00 - 19:00 | Event Control   | 5      | Event Control                      |
| 14:30 - 19:00 | CV & EV Acceleration  | 12     | Start/Finish Line                  |
| 15:00 - 18:30 | DV Skid Pad   | 3      | Dynamic Area                       |
| 18:30 - 20:00 | DV Practice Track   | 3      | Dynamic Area                       |
| 18:30 - 21:00 | CV Engineering Design Finals (not public)                           | 6      | FSG Forum                          |
|               |   |        |                                    |

STATUS/STAND: 20.07.2018 SCHEDULE 2018 **35** 

Jonas von Malottki Controlling Solutions and Business Intelligence, Germany (Stuttgart);

Hortense Denise Kirby HR Business Partner, USA (Dallas/Fort Worth);

Yu Chang Engineering Support Office, China (Beijing)



# Every day a new chapter. That's how we write history. That's us.

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# DAIMLER





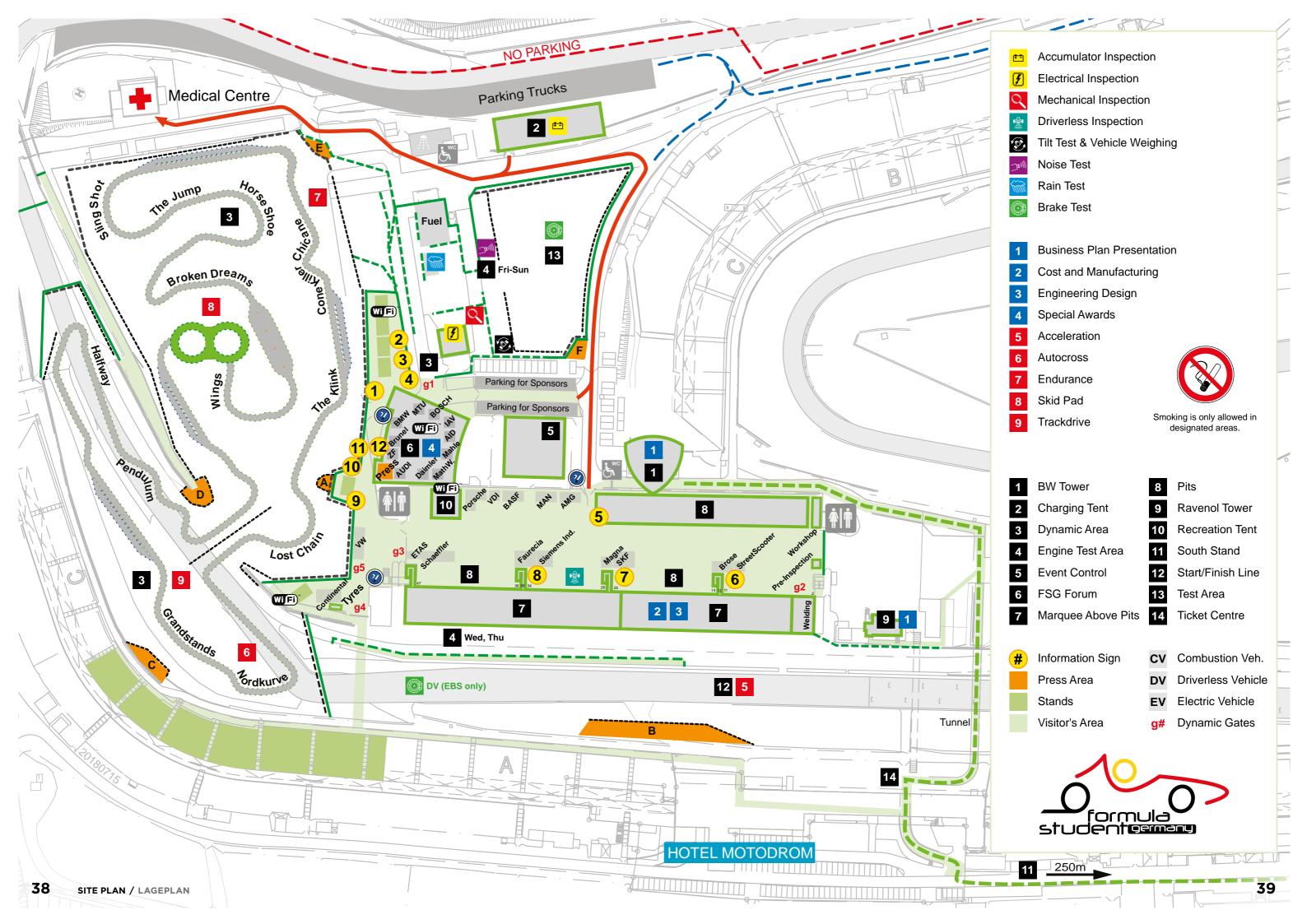
| Sat, 11       | th of August   |                                 |
|---------------|--|---------------------------------|
| 06:00 - 22:00 | Charging Tent  | 2 Charging Tent                 |
| 06:00 - 24:00 | Pits available   | 8 Pits                          |
| 07:15 - 12:30 | Event Control  | 5 Event Control                 |
| 07:15 - 18:00 | Ticket Centre  | 14 Ticket Centre                |
| 07:30 - 07:50 | Team Briefing  | 7 Marquee above pits            |
| 08:00 - 08:30 | DV Course Walk Trackdrive                                    | 3 Dynamic Area                  |
| 08:30 - 12:30 | DV Trackdrive  | 3 Dynamic Area                  |
| 08:30 - 18:30 | on request: Technical Inspections / Tilt, Brake, Noise, Rain | 2+3 Charging Tent, Dynamic Area |
| 08:30 - 19:00 | Fuel / Engine Test / CV & EV Small Practice Track            | 3 Dynamic Area                  |
| 11:00 - 13:00 | Worldwide Formula Student Officials Meeting                  | 1 BW Tower, 4.floor             |
| 13:15 - 13:45 | CV & EV Course Walk Autocross                                | 3 Dynamic Area                  |
| 14:00 - 19:00 | Event Control  | 5 Event Control                 |
| 14:00 - 19:30 | CV & EV Autocross  | 3 Dynamic Area                  |
| 19:30 - 20:30 | Free BBQ powered by VW Group                                 | Venue                           |
| 21:00 - 22:30 | Awards Ceremony - Part I                                     | 7 Marquee above pits            |

| <b>Sun, 1</b> a | eth of August                                    |                            |
|-----------------|--|----------------------------|
| 06:00 - 19:00   | Charging Tent                                    | 2 Charging Tent            |
| 06:00 - 20:00   | Pits & Recreation Tent available                 | 8+10 Pits, Recreation Tent |
| 07:15 - 12:30   | Event Control                                    | 5 Event Control            |
| 07:15 - 18:00   | Ticket Centre                                    | 14 Ticket Centre           |
| 07:30 - 07:50   | Team Briefing                                    | 7 Marquee above pits       |
| 08:00 - 08:30   | CV & EV Course Walk Endurance                    | 3 Dynamic Area             |
| 08:30 - 16:00   | Fuel / Engine Test / CV & EV Testing             | 3 Dynamic Area             |
| 08:45 - 13:00   | CV & EV Endurance Morning Session & Parc Fermé   | 3 Dynamic Area             |
| 12:00 - 20:00   | Dismantling of pits                              | 8 Pits                     |
| 13:30 - 18:00   | CV & EV Endurance Afternoon Session & Parc Fermé | 3 Dynamic Area             |
| 14:00 - 20:00   | Event Control                                    | 5 Event Control            |
| 21:00 - 22:00   | Awards Ceremony - Part II                        | 7 Marquee above pits       |
| 22:00 - 24:00   | MAHLE-Party                                      | 7 Marquee above pits       |

# Abbreviations

CV - Internal Combustion Engine Vehicle, DV - Driverless Vehicle, EV - Electric Vehicle Technical Inspections (A, D, E & M): Accumulator-, Driverless-, Electrical- & Mechanical Inspection

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# Exploring Formula Student Germany by yourself or on a **Guided Tour**

Welcome to Formula Student Germany. To help you make the most of your visit, we have prepared a tour for visitors, press and sponsors. You can follow the tour by following the numbered signs across the event site (see map above). If you wish, for a more personal experience, you can also

# Registering for a guided tour

If you would like to sign up for a guided tour, please head to the counter in the FSG forum, where you will be able to get more information on the timetable for the daily tours.

# **Exploring on your own**

The information signs are numbered 1 to 12. Following them der täglichen Führungen. in order will take you from the large dynamic area to the technical inspection and then on to the pit lane. Along the way you will learn about the history of the competition as well as the different competitions running in parallel (Combustion, Electric, Driverless). Don't be shy to ask team petition, so make sure not to hinder them! From the pit lane. the tour takes you back to the large dynamic area. The tour peting at Formula Student Germany 2017.

including an audio guide.

# Entdecken Sie die Formula Student Germany auf eigene Faust oder gerne auch als geführte Tour.

Herzlich Willkommen bei der Formula Student Germany! Um das Beste aus Ihrem Besuch zu machen, haben wir verschiedene Touren für Besucher, Presse oder Sponsoren vorbereitet. Die Tour verläuft entlang nummerierter Event-Stationen, quer über das Wettbewerbsgelände (siesign up to be guided by one of our experienced tour guides. he Karte). Für eine noch persönlichere Erfahrung können Sie sich gerne für eine geführte Tour bei einem unserer erfahrenen Tourguides anmelden.

# Registrierung für eine geführte Tour

Wenn Sie sich für eine Führung anmelden möchten, wenden Sie sich bitte an den Counter im FSG Forum. Dort bekommen Sie weiterführende Informationen über die Uhrzeiten

# FSG auf eigene Faust

Wenn Sie den Schildern der Reihe nach folgen (1-12), gelangen Sie vom großen fahrdynamischen Bereich (Dynamic Area) über die technische Abnahme (Technical Inspection) members anything you would like to know about their car, in die Boxengasse (Pit Lane). Auf dem Weg werden Sie eihowever, please remember they are participating in a comlichen parallel stattfindenden Wettbewerbe (Combustion. Electric und Driverless) in Erfahrung bringen können. Nutwill finish back at the FSG Forum, where you will be able to zen Sie die Gelegenheit und stellen den Teammitgliedern learn more about the background of the participants com- gerne jede Frage, die Ihnen auf der Seele brennt. Vergessen Sie dabei aber bitte nicht, dass sich die Studierenden A special bonus for smartphone users: try scanning the im Wettkampf befinden und nicht behindert werden sollten. QR- code on each sign to get more in-depth information, Von der Pit Lane führt die Tour zurück zum großen fahrdynamischen Bereich und endet am FSG Forum. Hier angekommen, warten noch weitere Informationen zum Hintergrund der Formula Student Teilnehmer auf Sie.

> Ein kleiner Bonus für Smartphone Besitzer: Scannen Sie gerne die QR-Codes an den Event-Schild entlang der Tour. um zusätzliche Detail-Informationen zu erhalten.







sure that the competition runs without a hitch.

The **red shirts** have jurisdiction over event control and event

The white shirts are in charge of the yearlong task of plan- Die White-Shirts sind für die ganzjährige Planung der ning the event and of ensuring that everything falls into Veranstaltung und deren reibungslose Umsetzung an den place as it should on race day. They are the "go-to" people Renntagen verantwortlich. Sie sind Ansprechpartner für for sponsors, press, participants and visitors and they en- Sponsoren, Medienvertreter, Teilnehmer und Besucher und stellen sicher, dass der Wettbewerb ohne Komplikationen verläuft.

support. The support team takes care of building up and Die Red-Shirts sind für die Bereiche "Event Control" und taking down of every physical transformation that turns the "Event Support" zuständig. Das Support-Team kümmert sich um den Auf- und Abbau aller infrastrukturellen Bestandteile, die den Hockenheimring in die Formula Student

Germany verwandeln. Sie sind die fleißigen Helfer, welche sicherstellen, dass das Event ohne Störungen verläuft. Darüber hinaus kommen die ehrenamtlichen Helfer als Streckenposten während der dynamischen Disziplinen zum Einsatz. Zudem besetzen sie das Event Control-Team und bilden damit die Schnittstelle zwischen Besuchern, Teammitgliedern, Sponsoren und Medienvertretern. Sie sorgen dafür, dass niemand hilflos auf dem Gelände zurückbleibt. Die *Red-Shirts* stellen insgesamt die größte Gruppe ehrenamtlicher Helfer bei der FSG dar. Nur durch ihre Hilfe ist es überhaupt möglich, die vielseitigen und mitunter spontanen Herausforderungen während des Events zu meistern.

45

THE VOLUNTEERS OF FSG / DIE EHRENAMTLICHEN DER FSG THE VOLUNTEERS OF FSG / DIE EHRENAMTLICHEN DER FSG

ny. We need them to ensure that the event runs smoothly. They also act as the track marshals get left lost or stranded. The *red shirts* are the largest group of volunteers at FSG and are the ones who will do what it takes to overcome any challenges that might be faced during the event.

The scrutineers - the folks in green- are there to Konstruktionswettbewerb handelt, tragen die guarantee that all the vehicles are safe. They ac- statischen Disziplinen in erheblichem Maße zur complish this by meticulously checking the cars for potential safety hazards and patiently assist- roren bewerten die Entwicklung, Fertigungsgüte ing the teams with any technical problems (at the event as well as throughout the year). A team may not participate in the dynamic events without receiving the go-ahead from our green-shirt- taillierten Geschäftspläne und nutzen dabei ihre ed volunteers.

team's scoring in the static disciplines is a big factor in its overall standing. It is the job of the ings. They look at the design, manufacturing quality and cost planning; they consider the ecofessional expertise, indispensible honesty and constructive criticism. Their feedback has resulted in the extensive improvements from the teams over the past years.

are tasked with timekeeping during the dynamic disciples as well as ensuring that all teams are given a fair and equal assessment. Not only this, but it is thanks to them that everyone at FSG can enjoy a high-speed Internet connection through- des Events auch lange nachdem sich der letzte out the entire event site!

Finally, we have the FSG media team, whose contributions through their video and image mate- Es ist uns Jahr um Jahr ein großes Vergnürials of exceptional quality and creativity, allow us to relive the most stunning and unforgettable moments of the event again and again, long af- cher und Sponsoren gleichermaßen wie für ter the smoke from the tires of the race cars has langjährige oder auch neuen Teilnehmern cleared.

It is our great pleasure to prepare a week of in- Und so freuen wir uns, Ihnen auch in comparable FSG excitement and entertainment diesem Jahr wieder mit Rat und Tat zur for visitors and sponsors alike, for veteran partic- Seite zu stehen. ipants and for those who are entering the event for the first time.

This year, we are happy to once again be at your service with advice and assistance!

Hockenheim Ring into Formula Student Germa- Die Scrutineers - die "Jungs in Grün" - stellen die Sicherheit aller teilnehmenden Fahrzeuge sicher. Sie überprüfen die Boliden der Teilnehmer akriduring dynamic events. They are in charge of bisch genau auf etwaige Sicherheitsmängel und the event control team, serving as intermediaries stehen den Teams bei technischen Problemen between visitors, team members, sponsors and mit ihrer Expertise helfend zur Seite (sowohl am Team darf man ohne die Freigabe unserer grün gekleideten Helfer nicht an den dynamischen Disziplinen teilnehmen.

Da es sich bei der FSG im Wesentlichen um einen Gesamtwertung bei. Die in blau gekleideten Jusowie das Kostenbewusstsein der Studenten. Sie betrachten die Wirtschaftlichkeit des Gesamtprojektes ebenso wie die Präsentation der de-Expertise und unvergleichlich ehrlich sowie konstruktive Kritik, welche bereits in vergangenen Since FSG is essentially a design competition, a Jahren positiv zur Weiterentwicklung der Studenten beigetragen hat.

judges in their blue shirts to render these scor- Ebenfalls oft im Verborgenen arbeiten unsere in schwarz gekleideten IT Spezialisten, welche für die Zeitnahme bei den dynamischen Disziplinen nomics of the project and whether the business verantwortlich sind und sicherstellen, dass jedes plan is convincing. For this, they utilize their pro- Team eine faire und gerechte Bewertung erhält. Doch nicht nur das: Dank ihnen steht allen Anwesenden bei FSG über das gesamte Eventgelände eine Highspeed-Internet-Verbindung zur Verfü-

Behind the scenes we have the IT experts, who Zu guter Letzt leistet das ebenfalls in schwarz gekleidete Media-Team in Form von Videos und Bildern seinen Beitrag, und sorgt mit beeindruckender Kreativität und Qualität dafür, dass wir die schönsten und unvergesslichsten Momente Rauch qualmender Reifen verzogen hat, noch einmal durchleben können.

> gen diese Woche an unvergleichbarer FSG Begeisterung und Unterhaltung für Besuauf die Beine zu stellen.



# Scrutineers and Redshirts 2017

# **Scrutineers**

BACHMEIR, Cornelius / BÄUERLEIN, Sonja / BERGMANN, Philipp / BÖCKLE, Bernhard / BRECHTMANN, Nick / CHARIF, Samir / CLAUSSNITZER, Eric / CLEMENS, Oliver / DIETZEL, Michael / EPPLE, Nico / FETZER, Matthias / GEBHARDT, Mathias / GOLLOWITZ, Lena / GÖTZ, Oliver / GROH, Jonas / HADER, Stefan / HAEDECKE, Tobias / HEGEDUS, Miki / HÖRSCH, Moritz / JAKOB, Dominic / KARL, Florian / KREHER, Tina / LEEB, Matthias / LORENZ, Martin / MAUL, Ralf / MONN, Marcial / MÜLLER, Winfried / OCHSENDORF, Nils / PASEBAND, Ameya / RIES, Eveline / RITZ, Thomas / RÖMMELMAYER, Christopher / SANTIAGO SACRISTAN, Sergio / SCHMITZ-RODE, Benedikt / SCHNAARS, Andrea / SCHOLZ, Juergen / SCHÖNEWOLF, Stefan / SCHUCKMANN, Dennis / STEMMLER, Alexander / STOLLBERGER, Martin / THOMASSEN, Kevin / TIEMANN, Maik / TORRES DA SILVA, Philipp / TRESP, Benjamin / TUITERT, Jet / VAN DEN BERG, Daniel / VAN DER PLOEG, Chris / VANDENHENDE, Wouter / VAUDLET, Oliver / VELZ, Nicolas / WAGNER, Florian / WALETZKE, Roman / WICHTERICH, Tobias / WISCHNEWSKI, Alexander / WITTICH, Mark / WOLFSBERGER, Stefan





ABDELWAHAB, Kareem Gamal / ANDRES, David / ANDREWS, Marie-Lene / AST, Maximilian / AUST, Verena / BAKHTOVARSHOIEV, Tymur / BARRABAS, Sascha / BAUFELD, Aaron / BAYER, Konrad / BHASKAR, Narendran / BOEHM, Maximilian / BORRMANN, Daniel / BRAUSER, Austin / BRUNGS, Yamina / CARNICERO CORTÉS, Àlex / CHAWLA, Shashank / CHENNIAPPAN KUPPUSAMY, Boobalan / DC, Prajwal / DE, Shidhartha / DE JONG, Stef / DEMELE, Antonia / DEMEURICY, Paul / DESHMUKH, Siddhant / DIETRICH, Franziska / FINDEISEN, Jan / FLEMMING, Erik / FORMILAN, Vittoria / FRASSINE, Alessia / FREUDENBERG, Liz / FREY, Dennis / GALLETTI, Edoardo / GANDHI, Ronak / GARLICHS, Keno / GEIER, Nicole / GERNERT, Björn / GREFE, Hinrich / GRUNENBERG, Kathrin / HÁJEK, Karol / AMZIĆ, Benjamin / HAUFFE, Björn / HENZEL, Judith / HIRSCHMANN, Jill / HOFMANN, Alina / HOFMANN, Peter / HURTIENNE, Denise / JANSSEN, Nele / JEITNER, Timo / JOHNSON, Kevin / JOSTEN, Jonas / KESHAVA REDDY SOPPAHALLI, Dhanush / KIRIT, Neel / KLEIN, Christian / KOPP, Alexandre / KRÄMER, Daniel / KRÜGER, Stephan / KÜHNE, Alexander / KULESZ, Dawid / LANSNICKER-DIETRICH, Bärbel / LEBKOWSKI JIMÉNEZ, Rosa / LERINGER, Nora / LESCHNIEWSKI, Ann-Catrin / LILIE, Ky Nam / LIMA DE CARVALHO, Luiz Fernando / LORENZEN, Morten / MARTYNUS, Oliver / MARU, Vivek / MEJLBJERG, Stig / MELLERGAARD, Simon Bach / MICHALOWSKI, Lars / MORGENROTH, Johannes / MÜLLER, Gábor / MÜLLER, György / MÜLLER, Lars / NEUHAUS, Marcel / PANDEY, Rahul / PAPENHUIJZEN, Thijs / PATHNI, Charu / PÉREZ MENDOZA, Ana Cristina / PERIYASAMY, Boopathiraja / PETERS, Oliver / PETERS, Jannik / PITUELLO, Mauro / POKER, Katharina / POLT, Markus / R. NEUMANN, Hendrikie / RANKIN, Alastair / RATHSACK, Felix / REIMERS, Dennis / REN, Huawei / SANTOS, Giovana / SAUTTER, Nadine / SAYOVITZ, Steve / SCHÄFER, Bastian / SCHAIRER, Pascal / SCHEMEL, Michael / SCHILDT, Sebastian / SCHINDLER, Corvin / SCHRÖDER, Yannic / SCHULZ, Elena / SCHWARZER, Johannes / SCHWEITZER, Desirée / STACH, Theresa / STAMPRATH, Christoph / STEFANUTTI, Renan / STEINWEDE, Vanessa / STEPHAN, Eva-Maria / STOTZ, Maximilian / TEIXIDÓ SANGENÍS, Carlota / TEZOTO FIGUEIROA, Ana Clara / THALHÄUSER, Dana / TIMMERMANS, Tristan / TÓTH, Álmos Dávid / VAN BALEN, Johannes / VAN DER WIJST, Hugo / VAN LEEUWEN, Tom / VAN SCHIE, Sebastiaan / VAUDLET, Philipp / WEIEN, Mira / WEITZ, Klara / WIEDEMANN, Jana / WIESENTHAL, Marvin / WILDEBOER, Dominic / WINKELMANN, Daniel / ZHAO, Wan / ZHU, Hui / ZIPS, Stefanie

# **Judges**

# 2018



# Autonomous Design & Engineering Design

AERTS, Joris / AHOLA, Mikko / AHRENHOLZ, Benjamin / ASCIOGLU, Andreas / BAENSCH, Simon / BANSAL, Amar / BECK, Erhard / BÖHNERT, Andreas / CZERWIONKA, Paul / DECKERS, Jean-Noel / DÖLLE, Norbert / DUDA, Jürgen / EBLI, Sebastian / ENDER, Stefan / ENZWEILER, Markus / ESTEVES ALBIERI, Gustavo / EVANS, David / EWERT, Sebastian / FELC, Igor / FISCHER, Matthias / FÖLLMER, Patrik / FRIEDMANN, Felix / Friedrich, Linus / FRIES, Benedikt / FROEMMIG, Lars / GARDUNO, Luis / GEMEINHARDT, Sascha / GERTH, Hendrik / GICKELEITER, Michael / GINETE, Joao / GOELLNER, Julian / GOLAKIYA, Nirav / GRAF, Michael / GROSVARLET, Pascal / GRUBER, Gregor / HAAG, Alexandre / HACK, Oliver / HAHN, Christoph / HAHNEMANN, Kristina / HANAUSKE, Reinhard / HANIGK, Martin / HANISCH, Thomas / HEIDRICH, Stephan / HENNINGS, Thomas / HERRMANN, Andreas / HO, Victor / HOLSCHUH, René / HÖLZGEN, Andre / HOMOCEANU, Silviu / JONES, Pete / KALANKE, Philipp / KAPELLOS, Christos / KASPAR, Jakob / KAUSSEN, Martin / KERBER, Michael / KLOSTERMANN, Sandra / KNIEBUSCH, Olaf / KOHNS, Lukas / KORTEN, Mike / KRAFT, Oskar / LECHTHALER, Albrecht / LENZ, David / LIEBST, Fabian / LIECHTI, Stefan / LOPEZ, Jose / MÄHLER, Mathias / MAILE, Florian / MALACK, Sebastian / MAREK, Christian / MARTIN, Joe / MICHAELS, Tobias / MISSLER, Christian / MUEHL, Nils / MUELLER, Rolf / MUEMMLER, Rainer / MÜLLER, Sebastian / MUR, Lukas / MUUSERS, Daniel / NEYRINCK, Christian / NIEMEYER, Constantin / OEHLER, Claus / ORTH, Felix / PADBERG, Jochen / PAIER, Michael / PEETERS, Matthias / PETRY, Markus / PETZ, Andreas / PHERSSON, Luke / PLOOG, Mareike / RAAIJMAKERS, Marvin / RAFFEINER, Florian / REETZ, Volker / REMMLINGER, Jürgen / RETTLINGER, Sebastian / RETTNER, Cornelius / RICHTER, Alexander / RICHTER, Christian / RIDERER, Dominic / ROUELLE, Claude / SANDER, Udo / SATTLER, Steve / SCHADE, Michael / SCHÄFER, Michelle / SCHIMMELS, Juergen / SCHOENBERG, Christopher / SCHÖNBORN, Daniel / SCHULZ, Achim / SEIB, Timo / SOENS, Andreas / SPEED, Benjamin / SPOIDA, Thomas / STEGMAIER, Timo / STEINMETZER, Mathias / TEUFEL, Simon / TORGOVNIKOV, Eugen / TSIOLAKIS, Vasileios / VELA, Nicolas / VÖLKL, Timo / WEBER, Martin / WEBER, Thomas / WEINGART, Robert / WEISHAUPT, Harald / WENGERT, Jochen / WÖHLER, Konrad / WUNSCHHEIM, Lukas / ZECHMANN, Hannes / ZEISLER, Jöran / ZHANG, Chen / ZINKE, Christopher



BAMBACH, Andreas / BREWIG, Jens / BRUENN, Katja / COLLIGNON, Cousin / PIERRE, Henry / DÖBELE, Franziska / EICKHOFF, Mathias / ESSER, Klaus / FAHR, Alexander / FERKEN, Reiner / HAHN, Thomas / HARTHERZ, Patrik / HAYN, Bernhard / HEIDEMEYER, Peter / HERBERTH, Helena / HERRMANN, Jesko / HODGKINSON, Philip / HODGKINSON, Raymond / JAMAI, Hichem / KAHLE, Philipp / KARSCH, Ulrich / KEIM, Sandra / KINSKI, Andreas / KLUG, Jens / LANGE, Stephan / LENZEN, Thomas /LÖFFLER, Maximilian / MAAT, Sarah / MARX, Anette / MERKL, Julia / MOREL, Romain / MUELLER, Andreas / NÄTHER, Sylvio / NIEMEYER, Reinhard / NUSCHELER, Barbara Christine / OTT, Tobias / PETERS, Jan / PORSCH, Stefan / PRINZ, Michael / RICHTER, Svenja / RINKA, Carsten / SCHMIDLECHNER, Matthias / SLEDZINSKI, Timo / STOCKHEIM, Andreas / TABATABAI, Stefan / VADEHRA, Bernhard Prem

# **Cost and Manufacturing**

BERTRAM, Michael / BHARTI, Devesh / BRONTSCH, Daniel / BRUNNER, Daniela / BUOB, Manuel / CAVKA, Natalija / DEINHARDT, Till / DONDO, Paolo / EGENTER, Vera / GIORGIONI, Carlo / GÖHNER, Lara / GRUNDNER, Harald / HACKER, Clemens / HAGL, Markus / HANFELD, Stefanie / HANSSMANN, Daniel / HERTH, Martin / KESORE, Kisnaduth / KLEIN, Thorsten / KOCH, Richard / KOURTIDIS, Apostolos / KÜHNE, Alexander / KURZEN, Michael / LAUCH, Kurt / LERCH, Carina / LINDNER, Thomas / MEIER, Peter / MEINCK, Wolfgang / MONEGATTI, Marco / MÜLLER, Karsten / NEUMANN, Bernd / OEHLER, Christoph / PILTZING, Roger / PINTO, Valerio / RAU, Fabian / SCHLEPPI, Roman / SIBUM, Alexander / STRAUBERT, Alexander / STROHBACH, Anja / SZIGHETI, Eva-Maria / VERBÜCHELN, Felix / WANNEMACHER, Christoph / WILDEBOER, Dominic / WILLIAMS, Dom



# Formula Student 2018 Germany Team

The team behind Formula Student Germany is divided into three groups. The board is responsible for Formula Student Germany, its operations, finances, sponsoring and overall strategy.

Das Team der Formula Student Germany ist in drei Gruppen unterteilt. Das Board trägt die Verantwortung für die Formula Student Germany und ihre Kooperationen sowie für Sponsoring, Finanzen und Strategie.



TIM HANNIG
Board (Chairman)
Jaguar Land Rover Ltd.



DANIEL MAZUR
Board (Management)
Formula Student Germany GmbH



RAINER KÖTKE
Board (Finance) & EC (Dynamics)
Volkswagen AG



DR. LUDWIG VOLLRATH
Board (External Relations)

The executive committee (EC) is responsible for the design and development of the competition. Each member of the EC is responsible for one of the fields of the competition and its organisation.

Das Executive Committee (EC) veranwortet die Ausgestaltung des Wettbewerbs. Jedes Mitglied ist für Vorbereitung und Durchführung eines Bereiches verantwortlich.



STEFFEN HEMER EC (FS-Driverless) TU Kaiserslautern



ROB OPDAM EC (Technical Inspection) Bosch Engineering GmbH



TORSTEN RILKA
EC (Statics) & Scoring & VSV
Volkswagen AG



ULF STEINFURTH
EC (Mechanical Inspection)
University of Applied Sciences Stralsund



JOHANNES KRATZEL EC (Event Support) Robert Bosch GmbH



KONRAD PAULE
EC (FS-Academy) & Pit Marshal
Dr. Ing. h.c. F. Porsche AG



DR. SEBASTIAN SEEWALDT EC (Rules) & Pit Marshal Dr. Ing. h.c. F. Porsche AG

The operative team (OT) supports the board and EC in the preparation and realisation of the event throughout the year.

Das Operative Team (OT) unterstützt das Board und das EC in der Vorbereitung übers Jahr und in der Durchführung des Wettbewerbs.



DANIEL AHRENS
OT (Merchandising)
Dentsu Aegís Network



CHRISTIAN AMERSBACH OT (FS-Driverless) TU Darmstadt



PHILIPP BANDOW
OT (Data Protection Data Logger)
Resonic GmbH



SARAH BATTIGE
OT (Electrical Inspection)
TU Dresden

RAPHAELA BIHR



OT (Business Plan Presentation) MAN Truck & Bus AG

**MATTHIAS BRUTSCHIN** 



OT (Event Support)
Daimler AG



BARBARA DECKER-SCHLÖGL
OT (Event Support)
Tesla



SVEN GRUNDNER
OT (Back Office)



SEBASTIAN HOPPE OT (Cost Event) ZF Friedrichshafen AG



PETER LEIPOLD
OT (Design Event)
ZF Race Engineering GmbH



BENJAMIN MÜLLER
OT (Mechanical Inspection)
Makita Engineering Germany GmbH



LENA PAULE
OT (Communications)
ABB AG



LEA PISSARRECK
OT (Event Control)



HELENA REINKE
OT (Event Manager Assistant)
Formula Student Germany GmbH



JOCHEN SCHMIDT OT (Dynamics) DLR



DR. KARSTEN STAMMEN
OT (Dynamics)
AUDI AG



CHRISTOPH BEISSWANGER
OT (Mechanical Inspection)
hsengineering



MARIA BONILLA-TORRES
OT (Electrical Inspection)
Technische Hochschule Köln



**OT (Event Support)**Siemens Industry Inc.

MATTHÄUS DECKER



**OT (Electrical Inspection)** University of Stuttgart

**TANJA HOFMANN** 

OT (Security)

in-tech GmbH

SIMON DENSBORN



ANKE LACHMANN
OT (VIP Lounge & Culina)
Step by Step - Studio für Ballett und
Bewegung



FABIAN LIESCH OT (IT & TK) Alpha Sigma GmbH



DOROTHEE NEBEL
OT (Communications)



ALIA PIERCE
OT (Communications & Media Team)
Continental Engineering Services



JOST PHILIP PÖTTNER
OT (Design Event)

Autonomous Intelligent Driving GmbH



CATHARINA SCHIFFTER
OT (Guided Tours & Communications)
The University of Edinburgh



TIM SCHMIDT
OT (Back Office)

Mankiewicz Gebr. & Co.



ESTHER TROMP
OT (Event Manager Assistant)
Formula Student Germany GmbH

FORMULA STUDENT GERMANY TEAM 2018

FORMULA STUDENT GERMANY TEAM 2018









# **ALEXANDRE HAAG**

CTO & Head of Technology, Autonomous Intelligent Driving GmbH

We're on a mission to develop a full stack for autonomous driving. AID combines the best of both worlds: the safety and scale of an automotive OEM and the agility of a software startup. Our team is the key for solving this challenge, day by day. We're looking for people with the passion and technical expertise typical of FSG.

Unser Ziel ist es, ein Software-Modul für das fahrerlose Fahren zu entwickeln. AID verbindet das Beste aus beiden Welten: Stabilität und die Möglichkeiten eines Automobilherstellers sowie die Agilität eines Software-Startups. Unser Team ist der Schlüssel zum Erfolg. Bei der FSG treffen wir Talente, die wir für AID begeistern möchten.





# **ANTJE MAAS**

Director International HR Marketing, AUDI AG

The fascination of Formula Student Germany: to us, being there means being part of a truly special atmosphere that we would not want to miss for anything. This is where we meet young, ambitious people from all over the world who are just as enthusiastic about automotive technology as we are at Audi.

Faszination Formula Student Germany: Dabei zu sein bedeutet für uns, Teil einer ganz besonderen Atmosphäre zu sein, die wir um keinen Preis missen möchten. Hier treffen wir junge und ambitionierte Menschen aus aller Welt, die von automobiler Technik genauso begeistert sind wie wir bei Audi.





# HANS-PETER BERINGER

Vice President, Head of Business Management Transportation, BASF SE

BASF's engineering plastics are widely used in the automotive industry for example in vehicles range from bodywork and chassis to interior trim and engine components. We consider "Formula Student Germany" to be a great opportunity to get in contact with ambitious and well-educated young people. Good luck to all teams!

Die BASF bietet eine Vielzahl von Kunststofflösungen für die Automobilindustrie an, angefangen beim Karosseriebau, über das Fahrwerk bis hin zu Innenausstattung und Motoranbauteilen. "Formula Student Germany" bietet uns die Möglichkeit, mit ambitionierten und gut ausgebildeten Nachwuchskräften in Kontakt zu kommen. Wir wünschen allen viel Erfolg.













Head of HR Marketing BMW Group

The BMW Group is very enthusiastic about its involvement in the Formula Student Germany. The challenges the teams face during the course of a season are also always faced by the BMW Group. We are, therefore, pleased when qualified participants from all over the world gain their first practical experience in the BMW Group.

Mit großer Begeisterung engagiert sich die BMW Group in der FSG. Die Herausforderungen, mit welchen sich die Teams im Laufe einer Saison konfrontiert sehen, beschäftigen auch uns bei der BMW Group immer wieder. Daher freuen wir uns, wenn qualifizierte Teilnehmer aus dem In- und Ausland ihre ersten Praxis-Erfahrungen in der BMW Group sammeln.







# MARTIN SCHNEIDER

Vice President Recruitment and Marketing Brose Group

We offer dedicated students who are technology enthusiasts the chance to take on responsibility at an international company and actively shape the future of the automobile. At FSG, we meet people who have what it takes to be successful: commitment, team spirit, and the will to win!

Wir bieten engagierten und technikbegeisterten Studierenden die Möglichkeit, in einer internationalen Firma Verantwortung zu übernehmen und die Zukunft des Automobils aktiv mitzugestalten. Bei der FSG treffen wir Menschen, die alles das mitbringen, was es braucht um erfolgreich zu sein: Einsatzbereitschaft, Teamgeist und den Willen zu gewinnen.









# **HEIDI STOCK**

Human Resources Management - Talent Management and Diversity

At Bosch, we're convinced: Diversity is enrichment and prerequisite for our strive to excellence. Behind these aspects stand associates with individual competencies, mindsets and experiences. Diversity is also what we're counting on at Formula Student: Hence we're supporting talents who work together in a team to master interdisciplinary challenges.

Bei Bosch sind wir davon überzeugt: Vielfalt ist Bereicherung und Voraussetzung für Spitzenleistungen. Dahinter stecken Mitarbeiterinnen und Mitarbeiter mit individuellen Kompetenzen, Denkweisen und Erfahrungen. Vielfalt zählt auch bei der Formula Student: Daher unterstützen wir Talente, die im Team die interdisziplinären Herausforderungen gemeinsam meistern.



# **Brunel**



# **MARKUS ECKHARDT**

General Manager

Brunel has been supporting the FSG since 2006. The aspiring engineers are especially important to us as they are full of imagination, passion and team spirit. Like us, they strive for technological advances in the automotive industry and together, we share the passion for realizing multifaceted engineering projects.

Bereits seit 2006 unterstützt Brunel die FSG. Denn die angehenden Ingenieurinnen und Ingenieure sind voller Ideenreichtum, Begeisterung und Teamgeist und Ieben den technologischen Fortschritt der Automobilindustrie ebenso wie wir. Gemeinsam teilen wir die Leidenschaft für die Umsetzung vielfältiger Projekte im Engineering.







# **BARBARA TEXTER**

Head of Employer Branding Germany, Continental AG

For over 140 years, Continental has been working on motorized individual mobility of the future. In order to continue this success story, we are constantly looking for qualified technical and management personnel. Top talent of the kind we are seeking can be found at the Formula Student competition.

Seit über 140 Jahren arbeitet Continental erfolgreich an der individuellen Mobilität der Zukunft. Um diese Erfolgsstory weiterzuschreiben sind wir ständig auf der Suche nach qualifizierten Fach- und Führungskräften. Diese Toptalente finden wir beim internationalen Konstruktionswettbewerb Formula Student.



# ETAS



# FRIEDHELM PICKHARD

President ETAS GmbH

Team spirit, commitment and the passion for technology and innovation – these are qualities that connect ETAS with all formula student teams. We share the thrills with our 30 teams as – with engineering skills and passion – they show their mettle under the toughest conditions. We wish all teams the success to be front-runners in the field!

Team-Spirit, Engagement und die Leidenschaft für Technik und Innovation - Eigenschaften, die ETAS und die Formula Student-Teams verbindet. Wir fiebern mit unseren 30 Teams mit, wenn sie mit Ingenieurskunst und Herzblut unter den härtesten Bedingungen zeigen, was sie können. Wir wünschen allen Teams viel Erfolg, um ganz vorne mit dabei zu sein!

# **DAIMLER**



# DR. ANNA-MARIA KARL

Head of Global Talent Sourcing, Daimler AG

Digitalization, electric mobility, autonomous driving, shared economy – all these factors change the branch tremendously. Therefore it is even more important to support top talents and to exchange ideas with them. Because we want to develop the best products together – today and in the future. Therefore Formula Student offers a perfect platform.

Digitalisierung, Elektromobilität, autonomes Fahren, Shared-Economy - all das verändert unsere Branche wie nie zuvor. Die Förderung von Top Talenten und der direkte Austausch mit ihnen sind umso wichtiger. Denn wir wollen heute und in Zukunft gemeinsam die besten Produkte entwickeln. Die Formula Student bietet dafür eine perfekte Plattform.



# ·faurecia



# **MATHIAS MIEDREICH**

Member of the Managing Board, Faurecia Automotive GmbH

FSG participants and automotive supplier Faurecia share some of the most important characteristics: A passion for innovation, ambition, determination and the courage to pursue unconventional and creative solutions. We are proud to be sponsor and are looking forward to meeting motivated and talented teams. Best of luck to everyone!

Die Teilnehmer der FSG und der Automobilzulieferer Faurecia haben vieles gemeinsam: Leidenschaft für Innovation, Ehrgeiz, Zielstrebigkeit und den Mut zu ungewöhnlichen und kreativen Lösungen. Wir sind stolz, als Sponsor der FSG dabei zu sein, und freuen uns auf den Austausch mit engagierten und talentierten Teams. Wir wünschen allen viel Erfolg!

# Leader in 3 activities #1 INTERIORS £4.8 billion sales #3 SEATING £6.6 billion sales



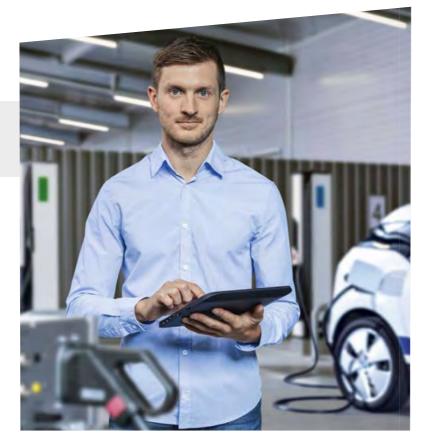


# **CHRISTIAN WILLENBERG**

Talent Acquisition & Recruitment

With over 7,000 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 more than 30 years of experience in developing innovative concepts and technologies for future vehicle generations. For further information about IAV, go to www.iav.com

IAV ist mit über 7.000 Mitarbeitern weltweit einer der führenden Engineering-Partner der Automobilindustrie. Das Unternehmen entwickelt seit über 30 Jahren innovative Konzepte und Technologien für zukünftige Fahrzeuggenerationen. Weitere Infos zu IAV erhalten Sie über unser Karriereportal www. iav.com/karriere



# MAHLE



# JOACHIM REICHLE

Vice President Corporate Personnel Development and Learning

If you want to make a decisive move, you need to have innovative ideas, courage, endurance and drive. If the environment fits and the team is right, innovative and convincing ideas emerge from visions. Our aim is to support talented and enthusiastic specialists and future executives in achieving their ambitious goals.

Wer Entscheidendes bewegen will, braucht Ideen, Mut, Ausdauer und Biss. Wenn dann noch das Umfeld stimmt und das Team das Richtige ist, werden aus Visionen innovative und überzeugende Lösungen. Unser Ziel ist es, talentierte und begeisterungsfähige angehende Fach- und Führungskräfte bei der Erreichung ihrer ehrgeizigen Ziele zu unterstützen.









# DR. GERALD HARZL

Vice President Human Resources, Magna International Europe

Magna is focused on providing innovative solutions to help define the mobility of the future. We are active at Formula Student to inspire the best young talent for our company. Therefore it is indispensable for us to be directly on site, where new fresh ideas emerge and are turned into reality.

Magna konzentriert sich darauf, innovative Lösungen zu liefern, um die Mobilität der Zukunft mitzugestalten. Wir sind bei der Formula Student aktiv, um die besten Nachwuchskräfte für unser Unternehmen zu begeistern. Daher ist es für uns unabdingbar direkt vor Ort zu sein, wo sich neue frische Ideen herausbilden und in die Realität umgesetzt werden.







# MONIKA SCHMIDT

Head of Talentmanagement, New Work & Employer Branding

Respect, team spirit, determination, costumer focus and integrity - these are the corporate values that our employees experience. For ideas that inspire. For changes that move. Every day we want to overcome borders and to continually make our products that little bit better. We are at home all around the world.

Respekt, Teamgeist, Entschlossenheit, Kundenorientierung und Integrität – das sind unsere Unternehmenswerte, die wir hier bei MAN leben. Für Ideen, die begeistern. Für Veränderungen, die bewegen. Tag für Tag möchten wir Grenzen überwinden und unsere Produkte noch ein bisschen besser machen. Dabei sind wir in der Welt Zuhause

60 partners 61







# **CHRISTOPH HAHN**

Automotive Competition Technical Lead

Employing a Model-Based Design approach to the automotive design process enables teams to design, test, validate and share their models within one environment. Using industry-standard tools such as MATLAB and Simulink help students tackle real engineering problems. www.mathworks.com/fsg

Mit MATLAB und Simulink lösen Teams der Formula Student Germany reale, automobiltechnische Probleme. Studenten, die modell-basierte Entwicklung einsetzen, entwickeln schneller und besser. Modell-basierte Entwicklung (Model-Based Design) erlaubt Lösungen zu testen und zu validieren bevor diese im Fahrzeug eingesetzt werden. www.mathworks.com/fsg







KONSTANZE MARINOFF
Director Human Resource Marketing

With more than 30.000 victories, Porsche, as the most successful manufacturer in motorsports, stands for Intelligent Performance and extraordinary team spirit. Become part of it and define the next chapter of the future of sportscar engineering – at the Formula Student competition and at Porsche. We wish good luck and success to all teams.

Mit mehr als 30.000 Rennsiegen steht Porsche als der erfolgreichste Hersteller im Motorsport nicht nur für Intelligent Performance sondern auch für einzigartige Teamleistungen. Werden Sie Teil davon. Schreiben Sie mit am nächsten Kapitel der Zukunft des Sportwagens - bei Formula Student und bei Porsche. Wir wünschen allen Teams viel Glück & Erfolg.



# MARKUS FISCHER

Manager HR Marketing and Employer Branding

MTU is one of the world's leading manufacturers of large diesel engines and complete propulsion systems. We are pleased to support this event and the upcoming engineers again in 2018. Karl Maybach, founding father of MTU and technical pioneer, would certainly love Formula Student Germany. And so do we. We wish all participants the best of luck!

MTU zählt zu den weltweit führenden Herstellern von Großdieselmotoren und kompletten Antriebssystemen. Wir freuen uns das Event und hochmotivierte Nachwuchsingenieure erneut zu unterstützen. Karl Maybach, MTU-Gründervater und Technikpionier, wäre begeistert. Wir sind es auch! Wir wünschen allen Teams einen erfolgreichen Wettbewerb!



# **SCHAEFFLER**



# **CORINNA SCHITTENHELM**

Chief Human Resources Officer

Team spirit, commitment, and a love of technology - those are the qualities that our employees and the Formula Student teams share. As a sponsor we are in close contact with the teams and support them financially and with our expertise. We want the participants to become passionate about our company, and applications from them are very welcome.

Teamgeist, Engagement und Leidenschaft für Technik – das sind Eigenschaften, die unsere Mitarbeiter und die Formula-Student-Teams verbinden. Als Sponsor stehen wir in engem Kontakt mit den Teams und unterstützen diese finanziell sowie mit unserem Know-how. Die Teilnehmer sind gern gesehene Bewerber, die wir für unser Unternehmen begeistern möchten.



# SIEMENS Ingenuity for life

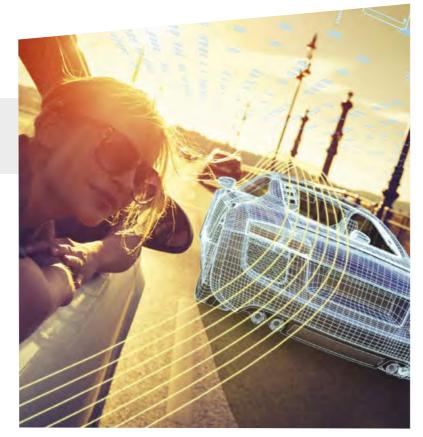


# **THORSTEN WALZ**

Manager Academic Business Germany

Team spirit, an infectious enthusiasm and the impressive professionalism of all the teams – that is what distinguishes the FSG. Siemens PLM Software is very proud of being the sponsor of this extraordinary competition since 2015 and is looking forward to the week in Hockenheim, which is a real highlight for us. Come and talk to us – it's worth it!

Teamgeist, eine ansteckende Begeisterung und die beeindruckende Professionalität aller Teams – das ist es, was die FSG auszeichnet. Siemens PLM Software ist sehr stolz darauf, seit 2015 Sponsor dieses außergewöhnlichen Wettbewerbs zu sein und freut sich auf die Woche in Hockenheim, die für uns ein echtes Highlight ist. Kommen Sie mit uns ins Gespräch – es lohnt sich!







# SANDRA, WEISSGERBER

Head of HR & Organisational Development

Together we can achieve something exceptional - every single day. This mindset made us the European market leader in the electronic commercial vehicle segment. As a revolutionary car manufacturer with start-up dynamics, we develop new standards in efficiency, economy and functionality. Join our team and shape the future of mobility yourself!

Gemeinsam Außergewöhnliches leisten - und das jeden Tag. Dies macht uns zum europaweiten Marktführer im elektronischen Nutzfahrzeugsegment. Als revolutionärer Automobilhersteller mit Startup-Dynamik setzten wir neue Maßstäbe in Effizienz, Wirtschaftlichkeit und Funktionalität. Werde Teil unseres Teams und gestalte selbst die Zukunft der Mobilität!



# A world of reliable rotation











# JANA HUEMMER

**Business Communication Specialist** 

It requires courage and endurance but also creativity and teamwork to face the challenges in the Automotive Industry. Qualities that you demonstrate already today. We are pleased to support young students from all over the world with such an ambitious project like Formula Student. On behalf of the SKF team we wish all participants good luck!

Es benötigt vor allem Mut und Ausdauer aber auch Kreativität und Teamwork um sich den Herausforderungen der Automobilindustrie zu stellen. Fähigkeiten die Sie bereits heute demonstrieren. Wir freuen uns daher sehr, Studenten auf der ganzen Welt bei einem so ambitionierten Projekt wie Formula Student unterstützen zu können und wünschen viel Erfolg!







# **DIPL.-ING. CHRISTOF KERKOFF**

VDI-Society Automotive and Traffic Systems Technology

VDI, the Association of German Engineers, is proud to be a partner and sponsor for Formula Student Germany since the very beginning. This competition is a model for other programs we run to stimulate interest in the engineering profession and to lend a hand to the future generation, and our members follow it keenly every year.

Der Verein Deutscher Ingenieure (VDI) ist stolz darauf, die Formula Student Germany seit Ihren Anfängen als ideeller Träger und Sponsor zu unterstützen. Dieser Wettbewerb ist ein Vorbild für andere Programme, mit denen wir das Interesse für Technikberufe wecken, den Nachwuchs fördern und er begeistert unsere Mitglieder jedes Jahr aufs Neue.







# PROF. DR. STEFAN GIES

Leiter Baureihe Mid/Fullsize Vehicles, Volkswagen AG

For Volkswagen, the main focus in Formula Student Germany 2018 is on autonomous driving and e-mobility. We want to talk to tomorrow's engineers about the mobility of the future. We look forward to brilliant ideas and thrilling races. Visit us at the Volkswagen Race Truck. We wish the participants every success.

Für Volkswagen stehen bei der Formula Student Germany 2018 autonomes Fahren und Elektromobilität im Fokus. Wir wollen mit Ingenieurinnen und Ingenieuren von morgen über die Mobilität der Zukunft reden. Wir freuen uns auf zündende Ideen und spannende Wertungsläufe. Besuchen Sie uns im Volkswagen Race Truck. Wir wünschen den Teilnehmern viel Erfolg.



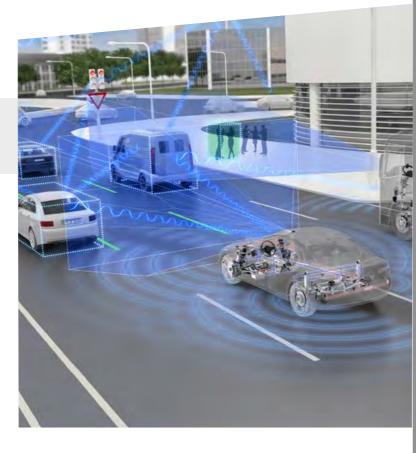


# MARTIN FRICK

Head of Talent Attraction

As one of the biggest automotive suppliers, ZF is dealing with digitizing mechanical systems, pushing forward e-mobility, and reducing road accidents and emissions. We support Formula Student to give the participants an early insight in our activities that shape the future of mobility.

Als einer der weltgrößten Automobilzulieferer beschäftigt sich ZF mit der Digitalisierung mechanischer Systeme, dem Forcieren der Elektromobilität und der Reduzierung von Verkehrsunfällen und Emissionen. Bei der Formula Student engagieren wir uns, um den Teilnehmern frühzeitig Einblicke zu geben, wie wir die Zukunft der Mobilität mitgestalten.





# Imprint

Formula Student Germany Magazine 2018

#### Duhlishar

Formula Student Germany GmbH

#### Editorial

Alia Pierce, Dorothee Nebel, Lena Paule, Andreas Stein

#### Design

Janin Liermann & Alexandra Blei, einfallswinkel PartG

#### Photos

Formula Student Germany:

Shidhartha De, Tilmann Hübner, Johannes Klein, Vivek Maru, Jan Pieper, Corvin Schindler, Elena Schulz, Markus Soukup, Daniel Sturm & Johannes Zenker

\* if without reference; excluding team profiles

# Team profiles

Text and pictures provided by the teams (July 2018)

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wenn ohne Angabe; Teamprofile ausgenommen

# Team-Profile

Text und Bilder bereitgestellt von den Teams (Juli 2018)

# Anzeigen

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MPRINT / IMPRESSUM

# **Impressions**





Green flag!



Champions







Let's watch the race



Pano photo - waiting...







Pre-race instructions













Team mascot



Sideways car

68 IMPRESSIONS IMPRESSIONS











































formula student germany





**72 73 IMPRESSIONS** IMPRESSIONS

# From the Track to the Stage – Top FSG Inventions

At Formula Student Germany, the innovation doesn't stop with the impressive race cars that the teams from all around the world come to compete with. Formula Student Germany itself is pure innovation based on an initial existing concept.

The volunteers who organize the event consist of a group of experts from different fields. This combination is what drives the competition to continue to advance.

To give you an example, here are our Top FSG Inventions from the race track to the award ceremony.

# Development in the Dynamics area:

# The "track marking" robot. In order to ensure the accuracy of the track that the teams race their cars on, FSG developed the "track marking" robot. This robot utilises GPS to locate where it is on the track and can accurately mark the track with the built in chalk spray.

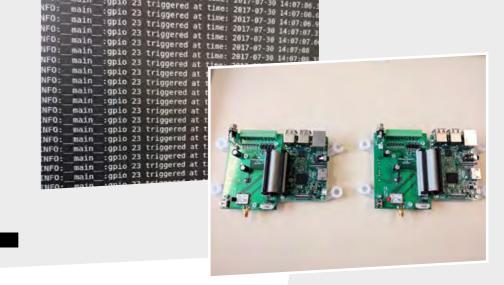


# Development of the Time-Keeping (TK) system:

#### This year, there will be new "Main Boxes" and new RFID Readers implemented.

An interesting aspect of this system is the close attention that is paid to the redundancy. All data that the system records will be saved in three different locations simultaneously (in the box, in the Event Control and directly to the internet). In the case that the "Main Box" fails, there is a back-up box (that is configured and booted) that sits in the TK bus, and can be immediately implemented. The box has a car battery, so that in the case that the power fails, the race can keep going. All parts have a backup, just in case a car decides to crash into the TK equipment, it can be quickly replaced to prevent any delay.





#### The new RFID readers

have a GPS module built in, so that the times of the cars can be measured to the nearest 100 micro-second. This innovation was developed together with the company u-blox.



implemented for Formula Student Germany has been developed specially for this Competition and "understands" how the different disciplines function. Standard software for racing doesn't understand the FSG rules and therefore can not be implemented. The FSG Software identifies the cars automatically (for example during Endurance on the start-finish line and the entrance/exit from the driver change area. From this, the Software can automatically understand what is happening during the race, e.g. when there is a "Meatball" flag.



# Development in the Awards Ceremony:



#### The slides know the winner first!

For those of you who have attended an FSG Awards Ceremony, you know that it NEVER starts on time! The reason is not because the FSG team are at the end of a very busy week and have given up, it is actually because of the time that is required after the Endurance is over in ensuring that the times that the TK team have recorded have been accurately turned into points, with the penalties deducted. Every year attempts are made to reduce this time, so that there is more time to party! The latest development automates the results directly onto the Awards Ceremony presentation. So when Tim and Alia say they don't know who the winner is, the information is so new that this is truly the case!





After completing his degree in Automotive Engineering at the Technical University of Braunschweig, where he spent four years being part of Formula Student in the Lions Racing Team, Christopher Zinke followed a career via Audi Sport and found his way to the Start-Up: Autonomous Intelligent Driving GmbH (AID). He is very happy with his position and the environment that he works in.

As an Alumni of Formula Student Germany and someone An der FSG teilzunehmen war eine unglaublich wertvolle Erit yet?

retrospective I am very happy with my career path in that fen kann. respect. I would not say "I made it" as this is just a choice that everybody can make.

**Christopher Zinke hat nach dem Studium** der Fahrzeugtechnik an der TU Braunschweig und seiner vierjährigen Formula **Student Zeit im Lions Racing Team den** beruflichen Weg über Audi Sport zum **Start-Up Autonomous Intelligent Driving** GmbH (AID) gefunden. Dort ist er sehr zufrieden mit seinem Arbeitsumfeld und seinen Aufgaben.

#### Als Formula Student Germany Alumnus hast du den Traum vieler FSG-Teilnehmer wahr gemacht und arbeitest nun für ein Start-Up. Denkst du, dass du es nun geschafft hast?

who has followed the dream of many FSG competitiors fahrung. Ich denke immer noch gerne an all unsere Höhen by working in a start-up. Do you feel like you have made und Tiefen zurück und wie wir letztendlich ein Team geformt und ein erfolgreiches Auto gebaut haben. Nach meinem Competing at FSG was an awesome experience. I still like Studium hatte ich wenig Interesse daran, als Ingenieur für to think back on all the ups and downs we had and how einen kleinen Schritt in einem riesigen Entwicklungsprozess we eventually managed to shape the team and the car to zuständig zu sein, ohne direkte Rückmeldung von Kunden be successful. After finishing my studies, I was concerned zu bekommen. Daher habe ich mich dafür entschieden, in about being an engineer in a big cooperation responsible einer Umgebung mit schnellen Produktiterationen zu arfor only a small step in an overall lengthy development beiten, durch die ich schnelles Feedback für meine Arbeit process with little feedback from customers. That's why I bekomme. Rückblickend bin ich sehr zufrieden mit meinem made the choice to work in environments with fast prod- bisherigen Karriereweg. Ich würde nicht sagen, dass "ich es uct iterations that provide quick feedback to my work. In geschafft habe", da ja jeder für sich diese Entscheidung tref-

#### What are your current roles within the company?

At AID our goal is to deliver an autonomous driving stack for the urban environment. My role is to build and run the technical product management based on the principles of agile development. That means we have self-organized engineering teams that strive to deliver the best possible value for the overall product. We develop the product in in- nisierte Entwicklerteams, die alle ihren bestmöglichen Beicremental steps to have fast feedback loops for everybody. Together with all teams my responsibility is to develop this incremental plan so that we build the best product possible.

#### Instead of following the typical path of a Start-Up environment - out in the middle of nowhere, working on your ideas, AID has been built up within Audi AG. What benefits did you feel that you gained by taking this route?

Working at AID certainly has the advantage that we have the financial backing of Audi while being completely independent in terms organization, processes and infrastructure. The financial backing allows us to make some long-term investments that are crucial for developing such complex technology like an autonomous driving stack. If we were a regular Start-Up we probably would focus more on short term results and suffer from a less sustainable approach in terms of design.

#### Why was this the right career choice for you?

I love having organizational and technologic challenges. Working at AID means building a team and developing all the necessary technology that is needed to build an autonomous driving stack for the urban environment.

Frage 5.: What is your message to the motivated students who are currently competing at FSG and who aspire to build up their own business in the future?

Competing at FSG equips you with the capability to build a team and a product that succeeds in a competitive environment. To be competitive you must make tradeoffs and find the right compromises on organizational, system and component level. Applying these principles in a professional business environment is a great step towards being successful with your product! /

#### Was sind deine aktuellen Aufgaben im Unternehmen

Unser Ziel bei AID ist es, eine Software für das automatische Fahren in städtischer Umgebung zu entwickeln. Meine Aufgabe besteht darin, auf Grundlage agiler Entwicklungsprinzipien das technische Produktmanagement aufzubauen und zu koordinieren. Wir haben selbst-orgatrag für das Gesamtprodukt leisten. Wir entwickeln das Produkt in inkrementellen Schritten und haben dadurch schnelle Feedbackschleifen für alle. Ich bin dafür verantwortlich, zusammen mit allen Teams diesen inkrementellen Plan zu entwickeln und kontinuierlich anzupassen, um das bestmögliche Produkt auszuliefern.

#### AID bedeutet nun nicht die allgemein geläufige Start-Up-Umgebung, d.h. die Arbeit an deinen eigenen Ideen irgendwo im nirgendwo, sondern ist eine Tochter der Audi AG. Empfindest du das als Vorteil?

Sicherlich profitieren wir bei AID davon, dass wir den finanziellen Rückhalt von Audi haben, aber in unserer Organisation, den Prozessen und der Infrastruktur komplett unabhängig sind. Durch die finanzielle Stütze können wir einige langfristige Investitionen tätigen, die entscheidend sind für die Entwicklung einer so komplexen Technologie wie das automatische Fahren in der Stadt. Wenn wir ein normales Start-Up wären, würden wir uns mehr auf kurzfristige Ergebnisse konzentrieren, statt Lösungen zu implementieren, die nachhaltig skalierbar sind.

#### Warum war das die richtige Jobwahl für dich?

Ich finde es großartig, organisatorischen und technologischen Herausforderungen gegenüber zu stehen. Bei AID bauen wir ein Team auf und entwickeln all die notwendigen Technologien für das automatische Fahren in der Stadt.

#### Was möchtest du all den motivierten Studierenden mitgeben, die aktuell an der FSG teilnehmen und gerne in der Zukunft ihre eigene Geschäftsidee verwirklichen möchten?

Durch die Teilnahme an der FSG lernt man sowohl ein Team aufzubauen als auch ein Produkt herzustellen, das absolut wettbewerbsfähig ist. Um das zu erreichen, muss man Abstriche machen und auf organisatorischer wie technischer

> Ebene die richtigen Kompromisse finden. Wenn man diese Grundlagen in die spätere Arbeitswelt überträgt, ist das ein riesiger Schritt, um mit dem eigenen Produkt erfolgreich zu sein!



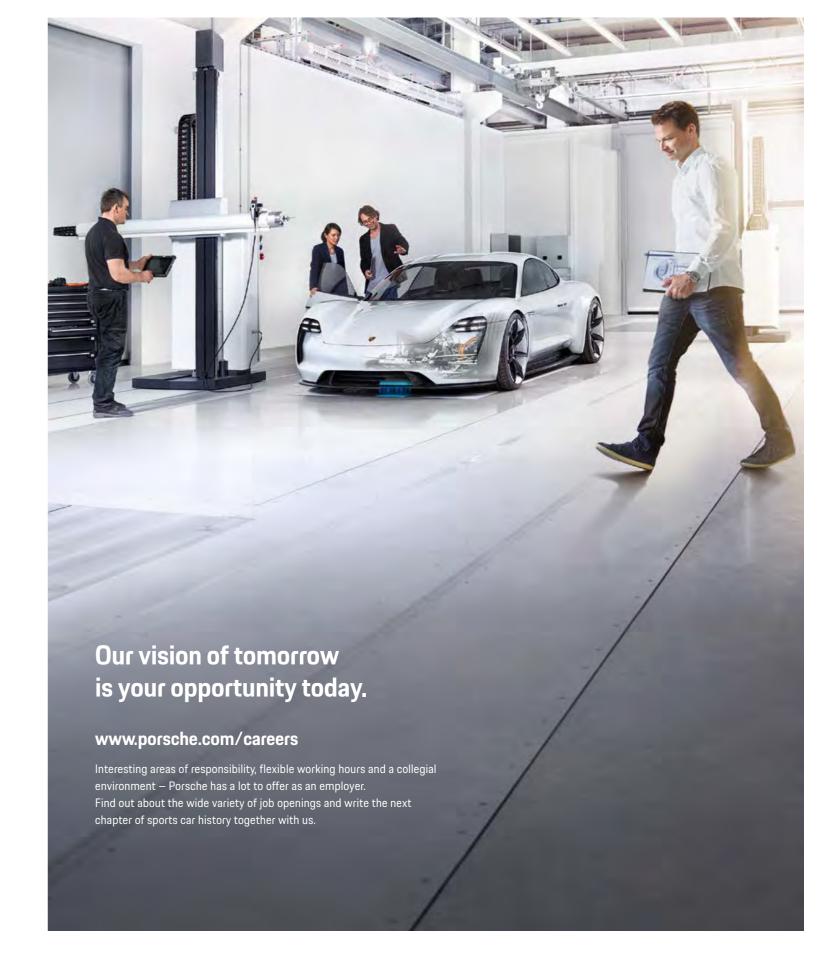
# Participating Formula Student Combustion TEAMS 2018





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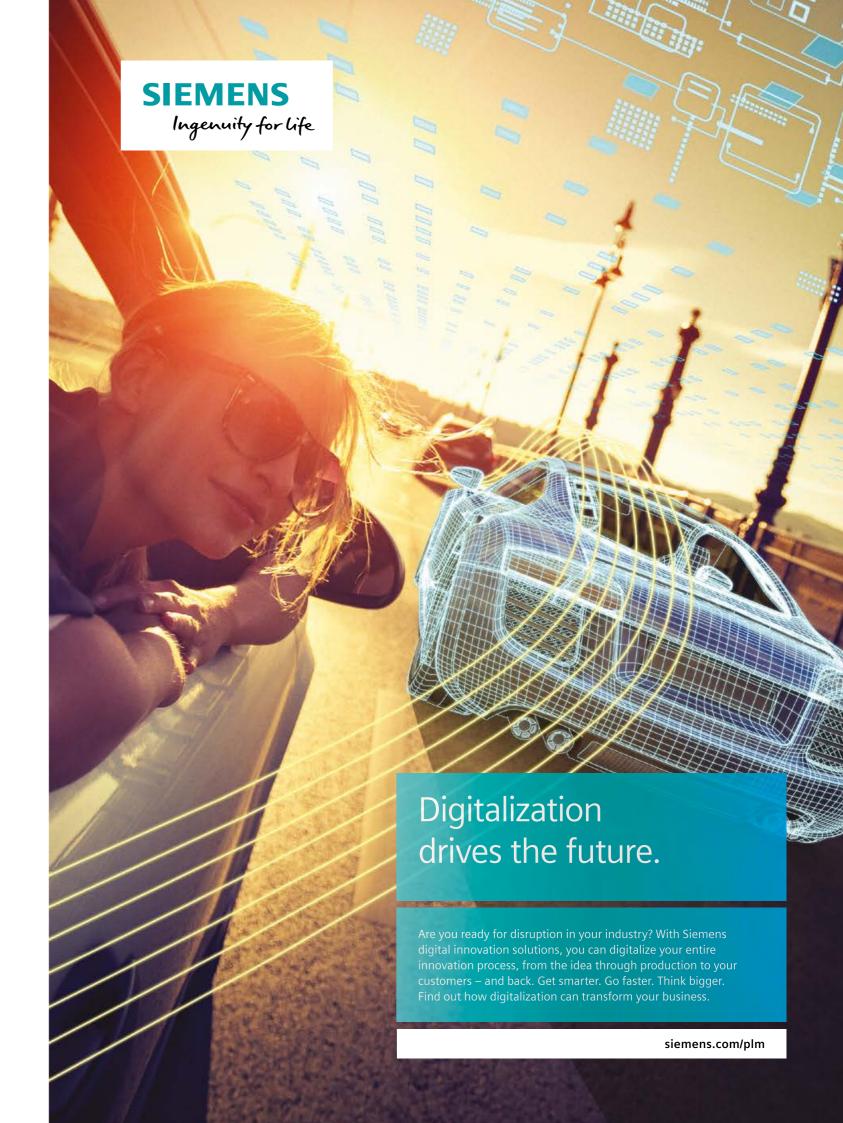
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#### Formula Student Team profiles

#### 23 nations 3416 students

**60 teams** Combustion

40 teams Electric

18 teams Driverless 3 Combustions / 15 Electric

#### **AACHEN**

**University of Applied Sciences Aachen** 



**WRL 420** 



Aixtreme Racing is a team of young individuals with their minds full of ideas, united in this year's FS18. Coming from FH Aachen University of Applied Sciences, we are perfectly prepared for independently constructing a flawless car due to the mind-set of educating in a very practical way. We have the chance to use the garages and machines, tools and connections for being able to present a high standard race car. We're exitendly looking forward to this season!











FRAME CONSTRUCTION composite CFRP monocoque /

MATERIAL CFRP with wooden sandwich core / HSS

**OVERALL L / W / H** 2563mm / 1445mm / 1118mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 132kg / 148kg SUSPENSION Double unequal length A-arm, pullrod actua-

TYRES (Fr / Rr) 205/470 R13. Continental C17 WHEELS (Fr / Rr) 7,5x13, 32mm offset, single piece, casted

ENGINE Yamaha Y7F-R6 Ri09 BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO 12.4:1** FUEL SYSTEM sequential manifold injection FUEL ROZ 98

MAX POWER/TORQUE DESIGN 12000 rpm/ 8500rpm **DRIVE TYPE** chain drive

DIFFERENTIAL limited slip (Drexler) with preload adjust-

**COOLING** electric water pump, sidemounted radiator BRAKE SYSTEM Custom rotors: 196mm front, 186mm rear. Hub mounted. ISR calipers 4 cyl front, 2 cyl. rear **ELECTRONICS** buy-solution with selfmade MIL-spec wiring loom and full-electric shifting

#### **AALBORG**

**Aalborg University** 

Car 281 Pit T-56

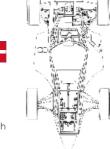
**WRL 304** 

AAU Racing has had a big turn over during the last years and we are now proud to present our new car G8. The design goal has focused on getting a solid base that we can develop further on in the future. The team members are still gaining experience and we hope that this year will teach us a great deal about the design proces we have gone through and ESG will show that our hard work has paid off.



**WRL 67** 





FRAME CONSTRUCTION Steel space frame MATERIAL Mild steel circular tubing

OVERALL L / W / H mm / mm / mm

WHEELBASE / TRACK (Fr / Rr)

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

**SUSPENSION** Double unequal length A-Arm. Pull rod actuated horizontally oriented spring and damper **TYRES (Fr / Rr)** 20.5 x 6.0-13, R25B, Hoosier / 20.5 x 7.0-13,

WHEELS (Fr / Rr) 6.5x13, 40 mm offset, 3 pc Al / 7.0x13,

ENGINE Honda CBR600RR PC37

BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 12.1:1 FUEL SYSTEM

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 11000 rpm/ 10100rpm DRIVE TYPE 520 chain drive

**DIFFERENTIAL** Drexler limited slip

**COOLING** Sidepod angle-mounted single pass radiator BRAKE SYSTEM Steel, hub mounted 222 OD 160 ID water

**ELECTRONICS** Aftermaket ECU, in house designed dash-board and communication + data acquisition boards



#### **AKRON**

University of Akron

Car 330 Pit T-72

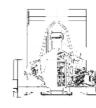
makes 7R18 more advanced than any before.

**United States** 

Zips Racing has been building car for competition since 1990. I those 28 year the team has seen the highs of 1st place overall finishes and the lows of DNF's on the last lap of endurance. Through it all Zips Racing has made a reputation for fast, well built cars. The ZR18 continues that tradition. With a focus on vehicle dynamics and tires. Akron's own Goodyear D2704's were selected as the tire of choice. Better team integration









**FRAME CONSTRUCTION** Tubular Space Frame with Bonded CFRP Honeycomb Composite Panels MATERIAL 4130 Chromoly Steel, CFRP, Ti, Al, Polymers OVERALL L / W / H 2979mm / 1377mm / 1200mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 123kg / 123kg SUSPENSION Double Unequal Length A-Arms, Pull rod

TYRES (Fr / Rr) 20x7x13, Goodyear D2704 / 20x7x13,

WHEELS (Fr / Rr) 7.0x13, 50mm Offset, 3pc Al / 7.0x13, 50mm Offset, 3pc Al ENGINE Yamaha WR450F

BORE / STROKE / CYLINDERS / DISPLACEMENT 95mm / 63,4mm / 1 cylinder / 449cc COMPRESSION RATIO 16 3:1

FUEL SYSTEM Student Designed Fuel Pump Control With FUEL E85

MAX POWER/TORQUE DESIGN 10500 rpm/ 9000rpm DRIVE TYPE 520 Roller Chain

**DIFFERENTIAL** Drexler Formula Student, Salisbury Type COOLING Dual Side Mounted Single Pass Radiators With

BRAKE SYSTEM Grey Cast Iron Floating Discs, ISR Brake

ELECTRONICS Motec M150 ECU, ACL, VIM, PDM,

FRAME CONSTRUCTION Tubular Steel Frame

and Pull rod (Rr) actuated spring and damper.

WHEELBASE / TRACK (Fr / Rr)

**OVERALL L / W / H** 2980mm / 1530mm / 1188mm

WEIGHT WITH 68kg DRIVER (Fr / Rr) 116kg / 133kg

MATERIAL 25CrMo4

#### BERLIN

Technische Universität Berlin





The FT18 Combustion is the 13th car in the evolution of FaSTTUBe racecars. It's focus is set on variability, reliability and aerodynamic design. The turbocharged one cylinder engine gives the car a boost of 85hp. As of this season our team has taken on the challenge of building two racecars simultaneously.

















TYRES (Fr / Rr) 18.0x7.5-10 Hoosier R25B / 18.0x7.5-10 WHEELS (Fr / Rr) 7.5x10, 25mm offset, Blackwave Carbon

SUSPENSION Double unequal length A-Arm. Push rod (Fr)

**ENGINE** 2007 BMW G 450 X BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO** 12,5:1

FUEL SYSTEM Self build aluminium tank, external fuel pump, two injectors, pressure regulator FUEL E85

MAX POWER/TORQUE DESIGN 7500 rpm/ 7000rpm DRIVE TYPE Chain drive, original gearbox

**DIFFERENTIAL** Self designed rigid axle COOLING Self build water-intercooler and cooler in the side box with fan mounted

BRAKE SYSTEM 4-Disk floating syst, hub mounted, 143mm(FR), 113mm(RA), ISR Calipers, Cockpit adjustable **ELECTRONICS** Self developed Body Control Unit, Bosch



**TEAM PROFILES FORMULA STUDENT 2018** 

#### **BIRMINGHAM**

**University of Birmingham** 

Car 212 Pit T-81 WRL 63 United Kingdom



2018 sees UBRacing making their 21st car and return to compete at Formula Student Germany for the first time since 2012. The team draws students from all years and degrees at The University of Birmingham into the Formula Student project, giving them a platform to grow their professional development on. The main focuses for this year's team were to introduce a new cooling system as well as redesign the aerodynamics package to help improve overall performance.













 $\mathbf{OVERALL\ L\ /\ W\ /\ H\ 2980mm\ /\ 1190mm\ /\ 1176mm}$ 

WHEELBASE / TRACK (Fr / Rr)

1600mm / 1220mm / 1145111111
WEIGHT WITH 68kg DRIVER (Fr / Rr) 131kg / 142kg **SUSPENSION** Double unequal length A-Arm, pull/push rod actuated vertically oriented spring and damper. TYRES (Fr / Rr) 190.5x101 Hoosier R25B, 190.5x101 Hoosier

WHEELS (Fr / Rr) CFRP Barrel aluminium centre 16mm offset/CFRP barrel aluminium centre 29mm offset

ENGINE Yamaha/YZF-R6 2005 BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO** 12.4:1

FUEL SYSTEM Common rail, Sequential port fuel injection

FUEL 99 RON Unleaded

MATERIAL 25CrMo4

MAX POWER/TORQUE DESIGN 10000 rpm/ 10000rpm DRIVE TYPE Single 520 size chain

DIFFERENTIAL Drexler 2010, FS LSD, 3Nm Clutch pre-load  $\begin{array}{l} \textbf{COOLING} \text{ Chassis mounted Al core fin radiator, double} \\ \textbf{pass, } 385\text{mm} \times 215\text{mm} \end{array}$ 

BRAKE SYSTEM 4-Disc system, self developed rotors with 190mm diameter, adjustable brake balance

**ELECTRONICS** wiring harness sealed to IP67, Multifunctional Steering Wheel, Electropneumatic Shifting

FRAME CONSTRUCTION Steel Space Frame

WHEELBASE / TRACK (Fr / Rr)

**OVERALL L / W / H** 2970mm / 1485mm / 1199mm

#### **BOCHUM**

Formula Student 2018.

**Ruhr University Bochum** 

Car 248 Pit T-84 WRL 292

This new race car is the third iteration of the RUB Motorsport lightweight

design, which was first introduced in 2016. This season, improvements

have been made to reliability and build quality while reducing weight

and refining driving characteristics. The RUB Motorsport team, consis-

ting of motivated students from various academic disciplines, proudly

presents its new race car: The RUB18, a nimble, competitive challenger in

Germany









**SUSPENSION** Double unequal length wishbone, pull rod actuated horizontally oriented spring and damper TYRES (Fr / Rr) 18.0x6 R10. Hoosier R25B

WHEELS (Fr / Rr) 7.0x10, Omm offset (Fr) -75mm offset **ENGINE** 2016 KTM 450 SX-F

BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO** 12.6:1

FUEL SYSTEM single point - sequential fuel injection sys-

FUEL 98 octane unleaded gasoline



tor (both side mounted) BRAKE SYSTEM 4-Disk system, self developed rotors,

electrically adjustable brake balance **ELECTRONICS** Self-designed PCB designs, Multifunctional Steering Wheel, el. operated clutch and shifter

**BOLOGNA** 

University of Bologna

Car 288 Pit T-71

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**WRL 203** 



Innovation, history, love and will to win: these are the three most important "components" of UniBo Motorsport. Since 2010 our project, in cooperation with the University of Bologna and many Italian automotive companies, is a concrete reality which helped not only the engineering students to approach how to be in a team and to achieve important goals. Audace is our latest creation, with a name that represents the pride that has driven us to develop it.













FRAME CONSTRUCTION Hybrid: front carbon fibre mono-MATERIAL

**OVERALL L / W / H** 2915mm / 1440mm / 1150mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 129kg / 149kg SUSPENSION Double whisbones, push rod actuation. dal springs, blade adjustable anti roll bar TYRES (Fr / Rr)

WHEELS (Fr / Rr) ENGINE

BORE / STROKE / CYLINDERS / DISPLACEMENT COMPRESSION RATIO

**FUEL SYSTEM** 

**ELECTRONICS** 

MAX POWER/TORQUE DESIGN rpm/rpm DRIVE TYPE DIFFERENTIAL COOLING BRAKE SYSTEM



Technical University of Brno

Car 274 Pit 46-C WRL 8

prove thatevery new formula we develop is better than the previous one.

The 2017 brought us our best results so far. This year we aim even higher.

Follow us to check the coolest car out there. This year it's called Dragon

8. The fastest Dragon around the FSG circuit yet. Spitting Dragon!

Czech Republic





MATERIAL **OVERALL L / W / H** 2928mm / 1481mm / 1162mm WHEELBASE / TRACK (Fr / Rr) WEIGHT WITH 68kg DRIVER (Fr / Rr) 124kg / 125kg SUSPENSION Double unequal length AI/CFRP A-Arm, longitudinally oriented heave spring
TYRES (Fr / Rr) Continental C18, 205/470 R13 WHEELS (Fr / Rr) 7,0x13, 30 mm ET, Magnesium

ENGINE Husqyarna FE 501, Turbocharged

BORE / STROKE / CYLINDERS / DISPLACEMENT

FRAME CONSTRUCTION Carbon fiber monocoque with

COMPRESSION RATIO 9,5:1

**FUEL SYSTEM** port fuel injection - Bosch injectors (EV12 353 g/min 2-Spray and EV14 765 g/min FUEL E85

MAX POWER/TORQUE DESIGN 10500 rpm/ 7500rpm **DRIVE TYPE** 3 gear transmission, Chain

DIFFERENTIAL Drexler formula student limited slip COOLING Side-mounted water and oil cooling custom radiators, electric fan

BRAKE SYSTEM 4-Disk system, self developed rotors with 210mm diameter, adjustable brake balance, ISF

FRAME CONSTRUCTION Front and rear Tubular space

MATERIAL 4130 steel round tubing 12mm to 25.4mm dia

OVERALL L / W / H 2941mm / 1421mm / 1186mm

**ELECTRONICS** Traction control, Launch control, Auto upshift, Calibration switches, Life-Racing F88 ECU



#### **CHANGSHA**

**Hunan University** 

Car 328 Pit T-74 WRL 109

Hunan University Racing Team was founded in 2006 as the first Formula

Student team in China, Nine cars has been designed and manufactured

up to now. The team took part in the Formula SAF West (USA) in 2007

China (FSC), and won the Champion of FSC in 2014. In 2015, the team

took part in Formula Student Germany(FSG), and the overall position

was 16th which has created the best result in Asia.

and 2008. From 2010 to 2014, the team participated in Formula Student







WHEELS (Fr / Rr) 7.7\*10,20mm offset,3 pc Al Rim

ENGINE Modified Honda CBR600RR F5 BORE / STROKE / CYLINDERS / DISPLACEMENT COMPRESSION RATIO 12.5:1

FUEL SYSTEM OEM, Fuel Injection

FUEL 98 octane unleaded gasoline

WHEELBASE / TRACK (Fr / Rr)

MAX POWER/TORQUE DESIGN 12500 rpm/ 11000rpm **DRIVE TYPE** Chain drive **DIFFERENTIAL** Drexler V3 limited slip,30-35Nmpreload,1.

**COOLING** Twin side pod mounted radiators with electronic

BRAKE SYSTEM 4 floating disks, adjustable brake balance,

ELECTRONICS TC,LC,Auto shift,MOTEC M84 ECU,ETC

FRAME CONSTRUCTION 3D space frame

WHEELBASE / TRACK (Fr / Rr)

MATERIAL A ST 52



#### CHENNAI

**Indian Institute of Technology Madras** 



Pit T-75

WRL 140

out to remain competitive to teams from around the globe in FSG2018.







SUSPENSION Double unequal length A-arms, pull rod actuated in front, push rod actuated in rear TYRES (Fr / Rr) 18 x 6-10, Hoosier R25B /18 x 6-10, Hoosier WHEELS (Fr / Rr) 7.0x10 35 mm offset, 1pc CF Rim /

WEIGHT WITH 68kg DRIVER (Fr / Rr) 135kg / 111kg

**OVERALL L / W / H** 2945mm / 1424mm / 1190mm

7.0x10 35 mm offset, 1pc CF Rim **ENGINE** KTM 390 Duke BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO** 12.88:1 FUEL SYSTEM Bosch , Port fuel injection

**FUEL** Gasoline MAX POWER/TORQUE DESIGN 9900 rpm/ 7400rpm

DRIVE TYPE Chain Drive **DIFFERENTIAL** Salisbury Type Limited Slip Differential **COOLING** Single core radiator mounted on the roll hoop bracing and electric fan

**BRAKE SYSTEM** 4-Disk system, floating cast iron rotors with 186 mm diameter, adjustable brake balance

**ELECTRONICS** Dashboard, Multifunctional Steering Wheel, Electropneumatic Shifting System

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#### COBURG

**University of Applied Sciences Coburg** 

Car 270 Pit 40-B WRL 20

Germany

The ocelot (Leopardus pardalis) is a wild cat native to the southwestern United States, Mexico, Central and South America, Its fur was once regarded as particularly valuable, but legal trade of its fur ceased decades ago. The C-18 Ozelot is also the 11th car of CAT-Racing. It is equipped with a CFRP monocoque paired with a steeltube rearframe chassis, powered by a 4-cylinder Yamaha R6 engine, a well-balanced high-downforce aerodynamic package and Hoosier 10" LCO on new developed CFRP









FRAME CONSTRUCTION hybrid chassis: rear spaceframe MATERIAL 200g/m² twill weave carbon fiber, 173g/m² twill weave aramid fiber, mild steel E355/S235 JR +C

OVERALL L / W / H 2981mm / 1520mm / 1180mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 127kg / 139kg **SUSPENSION** Double unequal length A-Arm/Pull rod actuated spring and damper / adjustable u-shape ARB

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

WHEELS (Fr / Rr) custom alumnium center/ CFK shell,

ENGINE Yamaha YZF-R6 rj05

BORE / STROKE / CYLINDERS / DISPLACEMENT 65,5mm / 44,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13.5:1

FUEL SYSTEM Multipoint fuel injection with Bosch EV14

FUEL RON 95 MAX POWER/TORQUE DESIGN 12500 rpm/ 8500rpm

DRIVE TYPE 520 Roller-Chain Drive

**DIFFERENTIAL** Drexler Slip Differential with reworked Locks; preload 30Nm - TBR = 4.00

**COOLING** two sidepod mounted 0,045m² core radiators, student designed 180mm suction fan, each 0,3m³/s

**BRAKE SYSTEM** 4-Disk system, self developed rotors, adjustable brake balance, fixed caliper

**ELECTRONICS** Selfdeveloped Live-telemetry and dashboard for driver information, shifting without lift

#### **CORVALLIS**

**Oregon State University** 

Car 211 Pit T-83 WRL 103



United States

Global Formula Racing is an internationally collaborative Formula Student team from Oregon State University and DHBW Ravensburg. Each year we build two cars, one combustion, and one electric, sharing chassis, aerodynamics and suspension packages. GFR18c features a redesigned aerodynamic package that produces more downforce at different vehicle attitudes. We look forward to seeing you in Hockenheim and are pleased to answer any of your questions so stop by our pit!









FRAME CONSTRUCTION CFRP monocogue with steel

MATERIAL Toray T700, aluminum and nomex core, varying

**OVERALL L / W / H** 2865mm / 1350mm / 1190mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 97kg / 115kg SUSPENSION Double unequal length a-arms, direct acting

TYRES (Fr / Rr) Hoosier 6.0/18.0-10 LC0 WHEELS (Fr / Rr) Student designed 3 pc Al-CFRP rim

ENGINE KTM 450 SX-F

BORE / STROKE / CYLINDERS / DISPLACEMENT 95mm / 63,4mm / 1 cylinder / 4 COMPRESSION RATIO 12.75:1

FUEL SYSTEM Honda CRF450R injector, in tank fuel pump

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 10000 rpm/ 8500rpm **DRIVE TYPE** Chain drive

**DIFFERENTIAL** Drexler limited slip differential COOLING Side mounted oil and water radiators

BRAKE SYSTEM Brembo and AP calipers, Tilton master cylinders, student design rotors

**ELECTRONICS** Motec, custom design CAN to sensor inter-

#### **DARMSTADT**

Technische Universität Darmstadt

Car 247

Pit T-66 WRL 512

It's the second year for our young team from Darmstadt. Our main goal is to proceed with the solid base from last year and implement some features. For this purpose, AMDA developed a basic racecar with a spaceframe, a turbo charged single cylinder engine and a suspension with topologically optimized wheel carriers.











FRAME CONSTRUCTION Welded steel MATERIAL E235+C

**OVERALL L / W / H** 3300mm / 1320mm / 1230mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 160kg / 120kg **SUSPENSION** Double unequal length A-Arm. Pull rod at the front axle and push rod at the rear axle. TYRES (Fr / Rr) 20x7 R13 Goodyear D2704 / 20x7 R13

WHEELS (Fr / Rr) 13 Aluminum 4H wheel 7x13

ENGINE KTM 690 LC4

BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO** 11,8/1

FUEL SYSTEM ECU Master EMU Black

MAX POWER/TORQUE DESIGN rpm/rpm DRIVE TYPE 6 Speed Sequential Gearbox

DIFFERENTIAL Spool **COOLING** Side mounted radiator with electric fan

BRAKE SYSTEM 3-Disk-System, two at the front, one at

**ELECTRONICS** selfdesigned Live-Telemetry System, selfdesigned PMU, Electric shifting and clutch system



**University of Applied Sciences Darmstadt** 

Car 242 Pit 37-C WRL 133

possible!

designed and manufactured a carbon fiber monocoque instead of a steel

aerodynamics and ergonomics. Now, we are ready to compete with the

best teams of the world and looking forward for a great event! A special

grid frame. In addition, there were inevitable changes to the chassis,

thanks goes to our supporters, who make this amazing experience

Germany





FRAME CONSTRUCTION Monocoque + rear tubular steel

MATERIAL CERP + S235

**OVERALL L / W / H** 2940mm / 1430mm / 1170mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 120kg / 147kg **SUSPENSION** Double unequal length A-arm, actuation via pullrods, adjustable dampers, anti-roll bar

TYRES (Fr / Rr) Hoosier 190/55 R10 (front and rear)

WHEELS (Fr / Rr) Keizer 10×7

**ENGINE** KTM SXF 450 custom modifications BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 14.35:1

FUEL SYSTEM Bosch single port injection EV14

FUEL E85 MAX POWER/TORQUE DESIGN 9500 rpm/ 6500rpm

DRIVE TYPE Chain/RWD

**DIFFERENTIAL** Limited Slip

**COOLING** right side mounted BRAKE SYSTEM 4-disk system with 200mm diameter (front/rear), fixed calipers, adjustable brake balance

**ELECTRONICS** FPGA based display unit, central power distribution unit. CAN sensor boards

FRAME CONSTRUCTION Steel Space frame



#### DORTMUND

**Technical University of Dortmund** 

Car 272 Pit 43-B WRL 430

think it is fast too.

It features the same concept as his predecessor but for the design

we started from scratch. Our main focus was on reliability but with a

self-made ECU, a launch control, a completely new suspension kine-

matic, new shifter mechanism and many other new bits we certainly

Germany

The FS218, nickname "Rüdiger", is the newest creation from GET racing.

**OVERALL L / W / H** 2732mm / 1378mm / 1248mm WHEELBASE / TRACK (Fr / Rr) WEIGHT WITH 68kg DRIVER (Fr / Rr) 123kg / 185kg SUSPENSION Double wishbone suspension with Pushrod actuated springs/dampers; ARB with torsion bar **TYRES (Fr / Rr)** Hoosier R25B 20.5x7 - 13 WHEELS (Fr / Rr) 7x13, aluminium rim ENGINE Yamaha R6 600ccm

MATERIAL 25CrMo4 and S235

BORE / STROKE / CYLINDERS / DISPLACEMENT 65.5mm / 44.5mm / 4 cylinders / 600cc

**COMPRESSION RATIO** 12.4:1 FUEL SYSTEM sequential multi-point fuel injection

FUEL RON98 MAX POWER/TORQUE DESIGN 11000 rpm/ 9500rpm DRIVE TYPE 520 roller chian

**DIFFERENTIAL** drexler limited slip differential, preloaded **COOLING** side mounted radiator and 300mm electric fan

**BRAKE SYSTEM** self developed floating rotors made of X20Cr13 with Wilwood GP 320, four-piston

**ELECTRONICS** self made ECU; launch-control; self made

#### **EDMONTON**

University of Alberta

Pit 38-A

The UAlberta FSAE team is a small but dedicated team from western Canada, returning to FSG for the first time in 5 years. We are incredibly excited to experience European competition and bring lessons learned back across the pond. Our car features a chromoly space frame chassis, carbon fibre body work, and dual a-arm suspension, powered by a turbocharged single cylinder 450cc engine. We are especially proud of our advanced driver ergonomics and fully electric shifting system.

**WRL 387** 





Canada





五百五

FRAME CONSTRUCTION Steel space frame MATERIAL 4130 Chromoly Steel **OVERALL L / W / H** 3014mm / 1473mm / 1186mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 84kg / 102kg **SUSPENSION** Converging unequal length a-arm. Pull(f) & push(r) rod actuated 4Way adjustable coil overs

**TYRES (Fr / Rr)** 20.5 x 7.0-13 Hoosier R25B WHEELS (Fr / Rr) 7.0x13,30mm offset, 1pc Magnesium

ENGINE Yamaha WR450F

BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO** 12.3:1

FUEL SYSTEM Keihin 387 cc Injector, conical spray pattern, single stage EFI system with wasted spark FUEL 98 Octane MAX POWER/TORQUE DESIGN 8000 rpm/ 7000rpm

DRIVE TYPE 520 Chain Drive **DIFFERENTIAL** Limited slip Salisbury differential with

three available torque bias settings COOLING Dual sidepod mounted radiator

**BRAKE SYSTEM** 4 Disk floating rotor system with drilled cast iron rotors and adjustable brake bias

**ELECTRONICS** Fully electric shifting, custom 21 channel datalogger w/ CAN sheild, LED tach/gear display



#### **ERLANGEN**

Friedrich-Alexander-Universität Erlangen-Nürnberg

Car 249 Pit 46-A WRL 192

Germany



High-Octane Motorsports e.V., founded in 2007, is participating for the 11th time in the Formula Student Combustion competition, 60 students of the Friedrich-Alexander University Erlangen-Nuremberg have been working together to build our newest racecar, the FAUmax lambda. We changed major components and established small innovations, e.g. our teams first full monocoque, a new aerodynamics concept, laser beam melted uprights, self designed piston and displacement magnyfing. FSG here we come!































FRAME CONSTRUCTION CFRP full monocoque in sand-

MATERIAL Plascore aluminium honeycomb core 20mm;

**OVERALL L / W / H** 2890mm / 1554mm / 1190mm

WHEELBASE / TRACK (Fr / Rr) 1530mm / 1240mm / 1150mm WEIGHT WITH 68kg DRIVER (Fr / Rr) 94kg / 123kg

**SUSPENSION** Double unequal length A-Arm, directly actuated spring / damper

TYRES (Fr / Rr) 18x6.0-10 LC0 Hoosier / 18x6.0 LC0 Hoo-

WHEELS (Fr / Rr) 6.0x10, 2.3 offset, 1 pc CFRP / 6.0x10, 1

ENGINE Modified KTM SX-F 450

BORE / STROKE / CYLINDERS / DISPLACEMENT 95mm / 72mm / 1 cylinder / 510cc

**COMPRESSION RATIO 14.9:1** 

FUEL SYSTEM Low pressure Bosch intake runner injektion

MAX POWER/TORQUE DESIGN 8000 rpm/ 7500rpm DRIVE TYPE Bevel-pinion gear

DIFFERENTIAL Spool

**COOLING** Side port single flow aluminium core radiator

BRAKE SYSTEM Self-made master cylinders, self-designed

**ELECTRONICS** Dezentralized control units, custom Vehicle

**FRAME CONSTRUCTION** Modular chassis consisting of a one piece Monocoque and a tubular rear frame

MATERIAL CFRP Monocoque with UD and fabric fibre, Nomex Honeycomb, 4130 steel rear frame

WEIGHT WITH 68kg DRIVER (Fr / Rr) 121kg / 137kg

WHEELS (Fr / Rr) 7x13, 48mm offset, 1pc Mg Rim

BORE / STROKE / CYLINDERS / DISPLACEMENT

MAX POWER/TORQUE DESIGN 9000 rpm/ 7500rpm

**DIFFERENTIAL** Adjustable limited slip differential

BRAKE SYSTEM 4-Disk system, self developed rotors,

**ELECTRONICS** self desinged/built harness with self developed ECU's, Motec Dashlogger

COOLING self developed u-flow water radiator

SUSPENSION fr: pullrod rr: pushrod actuated springs/dam-

**OVERALL L / W / H** 2970mm / 1442mm / 1198mm

WHEELBASE / TRACK (Fr / Rr)

**COMPRESSION RATIO** 10.0:1

FUEL SYSTEM Bosch MS4 Sport Turbo

ENGINE Fut 710

DRIVE TYPE Chain

adjustable brake balance

FUEL E 85

TYRES (Fr / Rr) Continental 205/470 R13

#### **ESSLINGEN**

**University of Applied Sciences Esslingen** 

Car 294 Pit T-76 WRL 2



Germany

As the reigning FSG Champion, all eyes will look on Rennstall Esslingen. With a completely new concept, the team would like to continue the successful way from the previous years. Having a new chassis, a new motor and a new suspension system, the whole car changed. It's hard to say what the new season will bring to the team because predicting a completely new car in its first season is hard. But if everything works like it should work, the team will again be able to drive into Top 5!













#### **GLASGOW**

University of Strathclyde

Car 215 Pit T-65

WRL 338 United Kingdom

For the 2017/18 season, the USM team is made up of 23 students from the engineering faculty. The team have been working hard to develop our 18th car - USM18. The design focus this year has been on reliability through testing time and enhancing the teams knowledge. Key new designs include a full new aerodynamics package, bonded CFRP stress panels and self developed exhaust muffler. The team would like to thank the University and our sponsors for their support this season.









FRAME CONSTRUCTION Single piece TIG welded space-MATERIAL E235+C cold drawn seamless tubing, carbon fibre and aluminium honeycomb core panels

OVERALL L / W / H 2900mm / 1400mm / 1170mm

WHEELBASE / TRACK (Fr / Rr) 1540mm / 1200mm / 1,18mm

WEIGHT WITH 68kg DRIVER (Fr / Rr) 124kg / 123kg **SUSPENSION** Front: Direct actuation unequal length A-arms. Rear: Push rod unequal length A-arm

TYRES (Fr / Rr) Hoosier LCO 6.0/18.0-10 WHEELS (Fr / Rr) 6061 Aluminium Spun

ENGINE Suzuki LTR - 450

BORE / STROKE / CYLINDERS / DISPLACEMENT 95,5mm / 62,8mm / 1 cylinder / 450cc

COMPRESSION RATIO 11.7

 $\ensuremath{\mathbf{FUEL}}$   $\ensuremath{\mathbf{SYSTEM}}$  Single point port injection controlled by DTA ECU

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 9000 rpm/ 9000rpm **DRIVE TYPE** Sequential 5 Speed

**DIFFERENTIAL** Drexler Limited Slip Differential

COOLING Left side mounted 377mmx180mm core downflow radiator, 7.56 cfm fan mounted to rear

BRAKE SYSTEM 4 disc system with 184 mm OD cast iron

**ELECTRONICS** Self developed wiring harness for DTA S80 ECU. Shift cut system for cluctchless upshifting

#### **GRAZ**

**Graz University of Technology** 

Car 253 Pit T-62 WRL 5

Austria

With the TANKIA 2018, the TU Graz Racing Team is competing with its 15th Combustion Car in the Team History. Every Year we try to further improve our car to reach a new level. With our 2018 contender we further improved on our single-cylinder concept by making TANKIA 2018 lighter, stronger and more reliable. At the same time we added new features to further push the boundaries and build an even better car. You are invited to visit us at our pit at any time.;)















#### FRAME CONSTRUCTION one piece CFRP monocoque **MATERIAL** carbon fibre prepregs, nomex and aluminium honeycombs, structural foam, cfrp and titanium **OVERALL L / W / H** 3022mm / 1413mm / 1174mm

WHEELBASE / TRACK (Fr / Rr) WEIGHT WITH 68kg DRIVER (Fr / Rr) 107kg / 115kg

SUSPENSION double unequal lengh A-Arm, pushrod actuontal orientated spring and damper TYRES (Fr / Rr) 18 / 6 - 10 Hoosier LCO /18 / 6 - 10 Hoosier

WHEELS (Fr / Rr) CERP

ENGINE KTM SX-F 450

BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 15.13:1

FUEL SYSTEM inlet manifold injection

FUEL E 85

MAX POWER/TORQUE DESIGN 9000 rpm/ 6500rpm **DRIVE TYPE** chain

**DIFFERENTIAL** limited slip differential

**COOLING** aluminium core oil and water radioator, water radiator with selfmade fan on the suction side **BRAKE SYSTEM** 4 disk system, electric adjustable brake balance, self constructed rear brake callipers

**ELECTRONICS** multifunctional steering wheel, electric clutch actuation, self designed live telemetry

#### **GRAZ**

University of Applied Sciences Joanneum Graz

Pit 38-C

**WRL 186** 



joanneum racing graz and its members - "The Weasels" - have been building racecars since 2003. The team consists of students of the U.A.S. Graz, Austria, who are alternating every year. Their cars have Always been super- or turbocharged. The newest member, the jr18, is equipped with a turbocharged Rotax engine and a CFRP gearbox housing. It has a CFRP Chassis with optimized suspension and aerodynamics for the 2018 Season. #NeverStopPushing









FRAME CONSTRUCTION CFRP monocogue sandwich construction with steel tube rear frame

MATERIAL High-tensile-strength carbon fibre prepregs.
Rohacell and aramid honeycomb core

**OVERALL L / W / H** 2970mm / 1599mm / 1180mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 124kg / 139kg **SUSPENSION** Double unequal lenght A-Arm, Pull rod actuation, coil spring & hydr. damper, Adj. roll bar

TYRES (Fr / Rr) Continental 205/470 R13 -34 M WHEELS (Fr / Rr) 7 inch wide, one piece handlaminated

ENGINE Modified Rotax 602 ACE with Turbocharger BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO** 8.6

**FUEL SYSTEM** Port injection system, Bosch injectors, one injector per cylinder, aluminum rail **FUEL** 100 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 6000 rpm/ 4500rpm **DRIVE TYPE** via gearwheels, integrated in gearbox **DIFFERENTIAL** 2010 DREXLER limited slip differential

**COOLING** two rear frame mounted one core radiators with BRAKE SYSTEM 4 disk system, floating, heat-treated laser

cut rotors with 230 and 210mm diam., aluminium ELECTRONICS Multifunctional steering wheel with display, Motorsport ABS, Electropneumatic Shifting Sys



**Technische Hochschule Mittelhessen UAS** 

Car 221

Pit T-82

**WRL 49** 

THM-Motorsport with its 20 team members is proud to present the F21-18 (Cathy) for the Teams tenth anniversary. Back at FSG Hockenheim stronger than ever. Our car is light, capable, and fast. This years goal is to get an efficient testing phase, to test and validate new constructions and features. A huge Thank you to everyone, who helped us to reach our goals. Please feel free to come and visit us at our Pit or Campside.





Germany









WHEELS (Fr / Rr) 7.0x13, 30mm offset, 1 pc Mg rim

FRAME CONSTRUCTION One piece tubular spaceframe MATERIAL E355 round tubes 12-25mm diameter **OVERALL L / W / H** 2700mm / 1440mm / 1125mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 133kg / 144kg SUSPENSION Double unequal length A-Arm. Push rod actuated spring and damper units. TYRES (Fr / Rr) 205/470 R13, Continental C17

ENGINE Modified Honda CBR600RR (PC40) BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO 13,4:1** 

FUEL SYSTEM sequential fuel injection

MAX POWER/TORQUE DESIGN 11500 rpm/ 9000rpm DRIVE TYPE chain drive, 3-speed modified gearbox **DIFFERENTIAL** Drexler formula student limited slip

**COOLING** left mounted water radiator with fan, right mounted oil radiator

BRAKE SYSTEM 4-Disk system, adjustable brake balance, **ELECTRONICS** wiring harness, multifunctional steering

#### 90 **TEAM PROFILES FORMULA STUDENT 2018**

#### GYŐR

Széchenyi István University Györ

to raise the bar even higher.

Car 279 Pit 40-A WRL 137

Established in 2014, Arrabona Racing Team represents the University of

Gy r since it's foundation as the most successful Hungarian combustion

competing in FSG, FSA and FS East, with 31 passionate team members,

ART 05 was designed and built with all our knowledge and experiences

engine team in Formula Student. This year, we are looking forward to

and a unique engine - supplied by SZEngine. Our brand-new race car,

Hungary

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 118kg / 122kg **SUSPENSION** Double unequal length A-Arm, Pull rod actuated spring and damper TYRES (Fr / Rr) 470x34 R13, Continental C18 / 470x34 R13,

FRAME CONSTRUCTION Tubular space frame with flexible

OVERALL L / W / H 2925mm / 1405mm / 1200mm

MATERIAL F235+C 12446 4130

WHEELS (Fr / Rr) 7x13, 30mm offset 1pc Mg Rim / 7x13, 30mm offset 1pc Mg Rim

ENGINE Student-build SZEngine EVO6

BORE / STROKE / CYLINDERS / DISPLACEMENT COMPRESSION RATIO 15.5:1

**FUEL SYSTEM** HP-Tech fuel pump, Sytec fuel pressure regulator and filter, KTM injector FUEL E85

MAX POWER/TORQUE DESIGN 8000 rpm/ 6200rpm DRIVE TYPE 420 chain

**DIFFERENTIAL** Clutch pack limited slip differential COOLING Single sidepod mounted radiator, with thermostic controlled electric fan

BRAKE SYSTEM Floating, hub mounted steel rotors, OD 217.5mm, Beringer master cylinder, ISR caliper

**ELECTRONICS** Display in steering wheel, Automatic upshift function, Expandable CAN network,







**Technion - Israel Institute of Technology** 

Car 219 Pit 37-B WRL 181



Formula Technion is participating in its sixth season in Formula Student. After switching to a single cylinder engine last year, the team was able to optimize engine systems and the rest of the car to reduce almost 50kg from the car's overall weight. Highlights of the car include custom electronic gear shifting and clutch actuators, low overall weight and a significant increase in aerodynamic performance.





FRAME CONSTRUCTION Welded Space Frame MATERIAL Stee **OVERALL L / W / H** 1920mm / 1400mm / 1180mm WHEELBASE / TRACK (Fr / Rr) WEIGHT WITH 68kg DRIVER (Fr / Rr) 105kg / 105kg SUSPENSION Double unequal length A-Arm. Pull rod

TYRES (Fr / Rr) Hoosier LCO WHEELS (Fr / Rr) OZ 10" Mg Rim ENGINE Modified KTM EXC-F 450 BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO** 12.8:1 FUEL SYSTEM Motec M1 sequential injuection FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 8000 rpm/ 7000rpm **DRIVE TYPE** 4-speed gearbox **DIFFERENTIAL** Drexler Limited Slip

**COOLING** Twin side-mounted radiator BRAKE SYSTEM 3-disk monobrake system

**ELECTRONICS** Custom electronic gear shifting and clutch

#### **HAMBURG**

**Helmut Schmidt University of Federal Armed Forces Hamburg** 

Car 372 Pit T-79

Germany



2018 is the first time in years that our team started and finished a car and we are proud to enter with the RUSH 18. While not having a stealth look this year, we do have a very interesting approach with our bodywork and many other components. That is 3D-printing rather than traditional carbon composite works. The RUSH 18 is once again raising our passion of engineering and it is the first of many steps into the team's future!









FRAME CONSTRUCTION Tubular space frame MATERIAL 235 Steel

**OVERALL L / W / H** 2615mm / 1520mm / 1084mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 125kg / 187kg SUSPENSION Double unequal length A-Arm.

TYRES (Fr / Rr) 205/510 R13 Continental 34M FORM.STUD. DRY/205/510 R13 Continental 34M FORM.STUD. DRY WHEELS (Fr / Rr) 6x13 ET 10,8 Braid Formrace 8/6x13 ET

ENGINE Honda CBR600 FS4i

BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO 12:1** 

FUEL SYSTEM student des/ built, fuel injection

FUEL 98 octane unleaded gasoline MAX POWER/TORQUE DESIGN 11000 rpm/ 10000rpm DRIVE TYPE Chain drive

**DIFFERENTIAL** GKN Driveline bevel gear differential **COOLING** single radiator with thermostatic controlled

**BRAKE SYSTEM** 4x250mm stainless steel rotors, adjustable break balance, AP Racing break caliber **ELECTRONICS** Multifunctional steering wheel, Electronic



#### **HAMBURG**

University of Applied Sciences Hamburg

a new generation of HAWKS racing cars.

Car 369 Pit 41-C WRL 175

It now features a V2 engine, a redesigned chassis and a new suspension.

gned". With our H14 (called "Vicky") we want to lay the groundwork for

Since we are building the "first 2 cylinder car, our team has ever desi-

Germany



seasons experiences, it was time to change the whole vehicle concept.

OVERALL L / W / H 2946mm / 1466mm / 1192mm WHEELBASE / TRACK (Fr / Rr) 1550mm / 1200mm / 1200mm WEIGHT WITH 68kg DRIVER (Fr / Rr) 125kg / 128kg **SUSPENSION** ouble mequal lenght A-Arms with push rod, decoupled roll, heave damper spring TYRES (Fr / Rr) Contitental 205x96 R13 WHEELS (Fr / Rr) 7x13-22mm offfset, oz rim

**ENGINE** Suzuki SV650 '99-'02 BORE / STROKE / CYLINDERS / DISPLACEMENT 81mm / 62,6mm / 2 cylinders / 645cc

**COMPRESSION RATIO** 11.5:1

**FUEL SYSTEM** student built, port fuel injection, one injector per runner, full sequentiell

FRAME CONSTRUCTION full body CFRP monocoque and

MATERIAL E323 prepreg, Aluminium Honeycomb, Ig-F

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 9500 rpm/ 6000rpm **DRIVE TYPE** student designed bevelgears

DIFFERENTIAL limited slip differential (Drexler), acc. 40°

-> 60%, decelleration 50° -> 42%

COOLING Undertray mounted radiator, electric water pump BRAKE SYSTEM 4-Disk-system, self designed, rotors with 270mm diameter, adjustable brake balance

ELECTRONICS Traction control, launch control, ABS, elec-



#### HEILBRONN

**Heilbronn University** 

Car 239 Pit 37-A WRL 310



The wings are back! The HNR18, the fourth car by HHN Racing, features a new aero package for increased downforce. This and a reworked suspension system allows us to master curves at higher speed. Further development of the engine leads to a power and torque gain of 15% compared to the HNR17. A novelty is the usage of custom ECU functions for the single-cylinder engine. For improved ergonomics, we use an e-paper display, new seat and shift paddles amongst other things.



FRAME CONSTRUCTION Welded steel spaceframe with

MATERIAL E335

OVERALL L / W / H 2932mm / 1398mm / 1181mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 127kg / 135kg SUSPENSION Double unequal length A-Arm. Pull rod actu-

ers, adjustable in compression and in r TYRES (Fr / Rr) 205/470 R13. Continental

WHEELS (Fr / Rr) OZ Formula Student 13

ENGINE Husqvarna SMR 510

BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 13.3:1

FUEL SYSTEM Bosch fuel injection EV14 L-Valve in student

designed housing in manifold

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 9000 rpm/ 8000rpm DRIVE TYPE Chain

**DIFFERENTIAL** Drexler Adjustable limited slip differential

**COOLING** left side mounted, single core, 240mm x 200mm, single electric fan rear mounted

BRAKE SYSTEM 4-Disk system, self-developed rotors with front 218 mm and rear 208 mm diameter, adj. brak

**ELECTRONICS** Bosch MS6 ECU;electropneumatic shifting & clutch;Telemetry;Instruments with LEDs & ePaper



#### KARACHI

National University of Sciences and Technology - Karachi

Car 268

Pakistan



NUST Formula Student Team holds the privilege of being the first ever Formula Student team of Pakistan. Ever since its debut in Formula Student UK 2012, the team has made consistent progress in all domains over the years, and went on to win the "Most Effective Communications Strategy Award" in FSUK 2014. Embodying the true spirit of Formula Student, the team has inspired and supported countless other teams to follow suit in representing Pakistan in Formula Student competitions all over the world







FRAME CONSTRUCTION TIG Welded Steel Tubular Space

MATERIAL Steel ANSI 1010

**OVERALL L / W / H** 2670mm / 1402mm / 1145mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 144kg / 144kg SUSPENSION Double unequal length A-Arm. Pull rod actu-

TYRES (Fr / Rr) 20.5" x 7.5" - 13C, R25B - Hoosier

WHEELS (Fr / Rr) Aluminum, 7x13, offset 22mm, OZ

ENGINE Honda / 2008 CBR600RR

BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO** 12.2:1 FUEL SYSTEM Honda Stock 12 Hole DENSO Injectors/Se-

FUEL 97 Octane

MAX POWER/TORQUE DESIGN 11000 rpm/ 7000rpm DRIVE TYPE 525 Chain Drive

DIFFERENTIAL Drexler FSAE LSD

**COOLING** Sidepod mounted 2 core Aluminum radiator, fan mounted to front of radiator on custom Aluminum shroud

93

**BRAKE SYSTEM** Hub mounted stainless steel floating 4 disks, 205mm dia and Aluminum PS-1 Wilwood calipers **ELECTRONICS** Motec M84 ECU controlling activity using 4 relays & 3 fuses for fuel pump,ECU & thermo fan



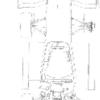


#### **KARLSRUHE**

Karlsruhe Institute of Technology

Car 308 Pit 43-C WRL 131

Germany



"One team-three cars!" KA-Racelng is designing, manufacturing and competing with an FSC, FSE and FSD car. The change to a single cylinder engine made the KIT17c lack reliability, so in 2018 the team from KIT decided to only focus on some minor changes and eliminate the problems. The result is an entirely new turbocharged engine concept, a completely new aerodynamic package and huge revolutions in the suspension, built around the chassis of 2017... At least they didn't change their beer.









FRAME CONSTRUCTION Hybrid Chassis with a CFRP MATERIAL HT and HM fibres, twill unidirectional plies,

OVERALL L / W / H 2925mm / 1510mm / 1190mm

WHEELBASE / TRACK (Fr / Rr) 1530mm / 1220mm / 1150mm WEIGHT WITH 68kg DRIVER (Fr / Rr) 98kg / 135kg **SUSPENSION** double unequal length A-Arm FA: Pull-Rod actuated inside of monocoque; RA: direct actuated

TYRES (Fr / Rr) 205/470 R13, Continental C18 WHEELS (Fr / Rr) 7"x13" CFRP, own design

ENGINE KTM 450SXF-T

BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 11.8:1

FUEL SYSTEM intake manifold injection FUEL E85

MAX POWER/TORQUE DESIGN 8250 rpm/ 5500rpm

DRIVE TYPE gearbox **DIFFERENTIAL** limited Slip differential

COOLING two rear mounted radiators with electric fans

BRAKE SYSTEM 4-Disk system, FEM optimized rotors, **ELECTRONICS** multifunctional steering wheel, graphical

terface, electronic clutch actuation

#### **KARLSRUHE**

**University of Applied Sciences Karlsruhe** 

Car 399 Pit 35-C WRL 180

Germany



High Speed Karlsruhe, founded in 2006, is entering its 12th season in the Formula Student combustion competition. About 50 students of the UAS Karlsruhe have been working together to build the new racecar, named F-112. The F-112 comes up with new suspension kinematics, a completely reworked aerodynamic package as well as a new monocoque. We are looking forward to the FSG, FSCZ and FSS competition.









#### FRAME CONSTRUCTION full CERP monocoque

MATERIAL carbon fibre with aluminium honeycomb core OVERALL L / W / H 2890mm / 1435mm / 1185mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 113kg / 117kg SUSPENSION Double unequal length A-Arm. Pull rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 155/67 R10 Hoosier LC0

WHEELS (Fr / Rr) 6.0x10, 4mm offset, 2pc AI/C Rim

ENGINE Suzuki RM-Z 450

BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO 15,2:1** 

FUEL SYSTEM Bosch MS6.1, sequential fuel injection and

FUEL E85 MAX POWER/TORQUE DESIGN 9000 rpm/ 7500rpm

**DRIVE TYPE** Chain Drive DIFFERENTIAL clutch pack limited slip, 10Nm preload,

COOLING 2 rear mounted radiators and 2 200mm electric

BRAKE SYSTEM 4-Disk system, self developed brake 2-piston calipers (FA & RA), adjustable brake balance **ELECTRONICS** 10 self-developed control/sensor units, electropneumatic shifting system, WIFI Telemetry

#### **KARLSTAD**

94

Pit T-67

Sweden



In July 2007 a group of students went to the Silverstone Circuit to see what Formula Student was all about. This resulted the start of a project at Karlstad University during the fall. Clear River Racing is the name that the new team took when building the first car and it is still the name that is used for the Formula Student project at Karlstad University. CRR has participated nine times at FSUK and in 2017 CRR finished 3rd. This year



the aim is FSG with our new, most advanced FSAE-car so far.









FRAME CONSTRUCTION Hybrid chassi: monocoque with sandwich stucture and tubular steel space frame

MATERIAL 200gsm twill, aluminum honeycomb 83,3 kg/m,

OVERALL L / W / H 2983mm / 1431mm / 1205mm WHEELBASE / TRACK (Fr / Rr)

SUSPENSION Double wishbone pull/push-rod suspention

TYRES (Fr / Rr) Hoosier LCO 18 x 6-10

WHEELS (Fr / Rr) Keizer 2pc modular design, aluminium.

ENGINE Modified KTM 500 FXC

BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 11.8:1

FUEL SYSTEM Custom direct fuel injection system, adjusta-FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 7400 rpm/ 6200rpm

DRIVE TYPE RK chain 520 MXU

**DIFFERENTIAL** Adjustable Formula Student Drexler Differential, Ravenol Racing Gear Oil COOLING Twin side pod mounted radiators with thermost-

atically controlled electric fans BRAKE SYSTEM Floating steel rotors with 192 mm diame-

adjustable brake balance, 4-piston calipers **ELECTRONICS** Multifunctional steering wheel, adjustable bars, pneumatic shifting system, DRS

#### **KASSEL**

University of Kassel



unsprung mass without loss of stiffness.

**WRL 47** 

The Herkules Racing Team from Kassel, founded in May 2009, is entering

its eighth season in the Formula Student combustion competition. The

are: high reliability paired with a high power-to-weight ratio, reduce the

team consists of about 35 team member. The Key facts for this year

Germany



MATERIAL CFRP with honeycomb sandwich material (Schütz Cormaster C1), E235, E355 10 to 34 mm

FRAME CONSTRUCTION front monocoque and rear steel

**OVERALL L / W / H** 2865mm / 1395mm / 1185mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128kg / 136kg **SUSPENSION** Double a-arm suspension, push rod linked on the lower a-arm, and a third element, (angeled TYRES (Fr / Rr) Continental C18 205/470 R13

WHEELS (Fr / Rr) OZ Magnesium Rim, 4 Hole, 30mm

ENGINE Suzuki GSXR 600 L1

BORE / STROKE / CYLINDERS / DISPLACEMENT COMPRESSION RATIO 13,6

**FUEL SYSTEM** Fully sequential injection with Bosch injectors and a FSE high pressure in-line fuel pump FUEL Ron 98

MAX POWER/TORQUE DESIGN 12400 rpm/ 60rpm DRIVE TYPE chain drive (pitch: 15,875mm; width 18m **DIFFERENTIAL** limited slip differential by drexler, adjustable preload, Castrol Syntrax Limited Slip 75W

**COOLING** side mounted radiator and one shot brazed oil cooler with 1244.396 cfm/988,349 cfm custom build fans BRAKE SYSTEM 4-Disk system, self developed rotors with 240mm (front)&227.5mm (rear), adjustable balance **ELECTRONICS** MoTeC PDM15, lightweight coated wires, notorsport connectors, 2D data logger, load cells

FRAME CONSTRUCTION Hybrid Monocogue Front: Com-

MATERIAL carbon-fibre composite; E235+C1 steel round

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

TYRES (Fr / Rr) 205/470 R13, C17 Continental/ 205/470

**OVERALL L / W / H** 300mm / 1430mm / 116mm

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

WHEELS (Fr / Rr) 7.47x13, OZ magnesium rim

**ENGINE** 2005 Yamaha R6 RJ 09 4 cylinder DOHC

BORE / STROKE / CYLINDERS / DISPLACEMENT

WHEELBASE / TRACK (Fr / Rr)

#### **KEMPTEN**

**University of Applied Sciences Kempten** 

Car 310 Pit 35-A WRL 221

ULDY PRESEND TOMSOI X!Top of the Mountains, Source of Infinity!

Germany

This year we designed the TOMSOI X. After nine fantastic cars we are proud to still improve the vehicle each time a bit more. With the change to prepreg, the maufacturing process is relieved for further saisons. For now we just made a negative prepreg form. But next time, the whole mono is made with prepreg. We want, that the car and all members of Infinity Racing will get there way to the top of the mountains.WE PRO-

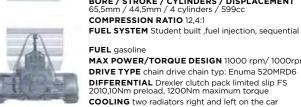












MAX POWER/TORQUE DESIGN 11000 rpm/ 1000rpm DRIVE TYPE chain drive chain typ: Enuma 520MRD6 **DIFFERENTIAL** Drexler clutch pack limited slip FS Nm preload, 1200Nm maximum torqu COOLING two radiators right and left on the car BRAKE SYSTEM Floating, Cast Iron, hub mounted, 200mm

ELECTRONICS Multifunction Steering Wheel, many sensors to proof all data of our car

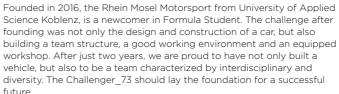
#### **KOBLENZ**

**Koblenz University of Applied Science** 

Car 333

Pit T-51













FRAME CONSTRUCTION Steel tube frame MATERIAL E355 1.0580 25x1.5 25x2 30x2 round steel **OVERALL L / W / H** 2690mm / 1380mm / 1200mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 113kg / 185kg SUSPENSION Double triangle with Push Road TYRES (Fr / Rr) 205x50 R13, Hoosier R25B / 205x50 R13,

WHEELS (Fr / Rr) 7.0x13.55mm offset Al Rim /

ENGINE Suzuki GSR 600 (2006)

BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO** 12.5:1

FUEL SYSTEM Injection 38mm

FUEL 98 octane Super MAX POWER/TORQUE DESIGN 12000 rpm/ 9600rpm

**DRIVE TYPE** Chain Drive **DIFFERENTIAL** Limited slip chain differential QDF7ZR

COOLING Liquid BRAKE SYSTEM 4-Disk system

**ELECTRONICS** wiring harness, separate electronic box, free programmable electronic control unit



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#### **KONSTANZ**

**University of Applied Sciences Konstanz** 

Car 343 Pit 44-A WRL 115

Germany



Founded at the UAS Konstanz in 2006, the Bodensee Racing Team proudly presents its 13th racecar, the ILTIS18. At the beginning of the season our team welcomed many motivated rookies and now consists out of about 30 students from all faculties. We make great effort to transfer knowledge to the new team members and together we made this year's ILTIS possible. This year's design focus on building a reliable car with a low COG but also the validation of simulations and effective testing.









FRAME CONSTRUCTION Tubular Space Frame MATERIAL SAF 4130

OVERALL L / W / H 2939mm / 1440mm / 1185mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 131kg / 131kg SUSPENSION Double wishbone suspension with CFK bes, aluminum inserts, steel a-arms and pullrod actu

TYRES (Fr / Rr) Continental 205/470 R13 34M WHEELS (Fr / Rr) 7x13, Mg Rim, OZ S.p.A.

ENGINE Modified Suzuki GSX R600 (k8) BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc COMPRESSION RATIO 12,3

FUEL SYSTEM multipoint injection

FUEL gasoline 98 ROZ

MAX POWER/TORQUE DESIGN 12000 rpm/ 8200rpm DRIVE TYPE orig. gearbox 3 gears, 520 chain drive **DIFFERENTIAL** Drexler LSD - Formula Student, 0-100Nm preload, TBR: drive 4/3.08/15.68; brake 2

**COOLING** two mounted radiators in the sidepods for oil and water. Elecric fans mounted on sidepod

BRAKE SYSTEM 4-Disk system, self developed rotors with 225mm diameter, adjustable brake balance

**ELECTRONICS** self-designed PDM, steering wheel with ed display, self-designed Live Telemetry

#### LINKÖPING

**Linköping University** 

Car 362 Pit 43-A WRL 227

Sweden



LiU Formula Student is a team of 70 members, of whom are this year competing with their 6th car. Approximately 40/70 members are working on the design and production of the car. ER18 is designed to be reliable and to have improved from previous years, in every event. The team believe that testing is key to a successful season, so they aim to have a drivable car as soon as possible. The teams' expectations are high this summer after a testing period of 15 weeks-an all time high for them.











FRAME CONSTRUCTION Steel space frame

MATERIAL High-strength Docol R8 steel tubes

**OVERALL L / W / H** 3023mm / 1365mm / 1188mm

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

WHEELS (Fr / Rr) 7x13. 1 pc Ma Rim / 7x13. 1 pc Ma Rim

ENGINE Modified Honda CBR600 RR BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO 13.5:1** 

FUEL SYSTEM Nira i7x

FUEL E85

MAX POWER/TORQUE DESIGN 10500 rpm/ 10100rpm DRIVE TYPE Chain 520 **DIFFERENTIAL** Drexler limited-slip differential, 40°/50°,

COOLING Sidepod mounted 264x330x50 core al. radia-

tor,1600 cfm fan mounted to shroud BRAKE SYSTEM 3-Disk system (2 front, 1 rear mounted on

**ELECTRONICS** Electropneumatic Shifting System, selfdesigned Live-Telemetry System, flat shift

#### LUND

**Lund University** 

Car 277

**WRL 299** Pit T-57

Sweden

Presenting the LFS-18, the tenth car from Lund Formula Student. Designed and built by 35 students from 4 different engineering faculties since September 2017. It is a continuation on the concept from LFS-17, with big changes to the suspension, powertrain and aerodynamics. This year we are determined to break our recent streak of negative results, and return to being one of the top European combustion teams. We would like to thank all our sponsors for making the LFS-18 possible!









FRAME CONSTRUCTION CFRP reinforced tubular steel

MATERIAL Cold drawn seamless steel tubes, CFRP foam OVERALL L / W / H 2968mm / 1416mm / 1181mm

WHEELBASE / TRACK (Fr / Rr)
1570mm / 1190mm / 1190mm

WEIGHT WITH 68kg DRIVER (Fr / Rr) 125kg / 153kg SUSPENSION Double unequal length A-arms. Direct actua-TYRES (Fr / Rr) 18.0x6.0 Hoosier R25B / 18x7.5 Hoosier

WHEELS (Fr / Rr) 7x10 Split aluminium rim, milled center.

**ENGINE** Modified Honda CB600E BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 14:1

**FUEL SYSTEM** Port injection with single injector per cylinder, placed on intake runners. FUEL F85

MAX POWER/TORQUE DESIGN 10500 rpm/ 9000rpm **DRIVE TYPE** Chain drive

**DIFFERENTIAL** Limited Slip Differential **COOLING** Twin side mounted aluminium radiators with

BRAKE SYSTEM 4 floating hub mounted steel disks. 2 piston rear calipers, 4 piston front calipers.

ELECTRONICS Electronic Throttle, clutchless shifting,

#### **MAGDEBURG**

Otto von Guericke University of Magdeburg

Car 220 Pit T-58 WRL 324

business plan idea, be more shiny and colourful...

The year is 2018 AD. Saxony-Anhalt is totally occupied by creebying

drivers. Well, not entirely... One small workshop with 50 indomitable

students still holds out against the invaders. And life is not easy for the

slow sneaky drivers from all over the Formula Student world who wants

to challenge the UMD Racing team, overtake our race car with its GSR

600 Suzuki motor, have a more orange aero package, develop a better

Germany





OVERALL L / W / H 2914mm / 1380mm / 1130mm WHEELBASE / TRACK (Fr / Rr)

FRAME CONSTRUCTION Turbular welded space frame

WEIGHT WITH 68kg DRIVER (Fr / Rr) 138kg / 150kg

SUSPENSION Double unequal length A-Arm., Push Rod actuated spring and damper

TYRES (Fr / Rr) 205/470/R13 34M Contintal C17 WHEELS (Fr / Rr) mg rim, 7x13, offset 30

ENGINE Suzuki GSR-600 K6

BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO** 12.5:1

FUEL SYSTEM Suzuki OEM injektors, custom made rail

FUEL RON 98

MATERIAL E355

MAX POWER/TORQUE DESIGN 10500 rpm/ 8200rpm DRIVE TYPE chain, OEM gearbox

**DIFFERENTIAL** Drexler Formula Student Differential COOLING Side mounted radiator with 225mm electric fan BRAKE SYSTEM Fully self developed brake system in 4th

**ELECTRONICS** selfdesigned live-telemetry system, elctrical shifting system, freely programmable ECU

FRAME CONSTRUCTION Steel tube spaceframe, CF panel

MATERIAL 1020 and 4130 steel tubing, composite panels,

WEIGHT WITH 68kg DRIVER (Fr / Rr) 134kg / 145kg **SUSPENSION** Double unequal length A-Arm. Direct acting spring and damper. Rear anti-roll bar.

TYRES (Fr / Rr) 190x53 R10, Hoosier R25B / 190x53 R10.

WHEELS (Fr / Rr) 8x10, +3 inch offset, 3 pc CF rim, Al centre / 8x10, 0 inch offset, 3 pc CF rim, Al centre

BORE / STROKE / CYLINDERS / DISPLACEMENT

7075-T651, Al rear bulkhead **OVERALL L / W / H** 2985mm / 1391mm / 1185mm

WHEELBASE / TRACK (Fr / Rr)

ENGINE 2017 KTM 690 Duke-R



#### **MELBOURNE**

Monash University

Car 266 Pit T-80 WRL 6

Australia

Based in Melbourne, Australia, Monash Motorsport consists of 100+ undergraduate students operating as one team responsible for both an IC and EV car. 2018 will mark the first time Monash competes overseas. in both classes, with the goal to maximise the sum of points across the two vehicles. M17-C features a KTM 690 Duke-R and new aerodynamics developed in the Monash Wind Tunnel. With 2000+ km of testing and driver training under its belt, M17-C is ready to take on the competition













BRAKE SYSTEM Outboard 4 disc system, high tensile steel rotors, adjustable brake balance ELECTRONICS MOTEC ADL, ECU and PDM15, electropneumatic shifting, multi-mode launch control



#### **MILANO**

Polytechnic University of Milan

Pit 41-A



Dynamis PRC, the 2017 most successful Italian FS team is presenting you the DPX. Considering the latest trends where the "X" version introduces tons of new features and characteristics, we designed our latest prototype aiming at overwhelming the performances of the previous generations of vehicles. A completely revolutionized CFRP monocoque, a new extremised wing package, carbon fibre rims and lighter tyres are only few of the profound changes presented by the DPX.











FRAME CONSTRUCTION Full CFRP monochoque MATERIAL Carbon fibre, alluminium and nomex honeycomb, roachell, alluminium and carbon fibre hardpoints **OVERALL L / W / H** 2968mm / 1401mm / 1187mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 119kg / 129kg **SUSPENSION** Adjustable double carbon fiber wishbone, Pull-Rod, Adjustable Shock Absorber and ARB TYRES (Fr / Rr) 185x40 R13, Pirelli / 185x40 R13, Pirelli

WHEELS (Fr / Rr) 7.0x13, 10mm offset, CFRP Rims/7.0x13, ENGINE Modified Aprilia RXV 550

BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO** 12.5:1 FUEL SYSTEM EFI euro4, full sequential fuel injection

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 10250 rpm/ 8750rpm **DRIVE TYPE** Chain drive

DIFFERENTIAL Drexler Formula Student LSD. Lock-up 88% power 51% coast 25 Nm preload

COOLING Two lateral mounted water radiators 2500cc with 188mm electric fan, one oil radiator 768cc BRAKE SYSTEM 4-Disk system, self developed rotors with

ameter, adjustable brake balance **ELECTRONICS** Selfdesigned: Steering Wheel, Electronic Shifting System, Live-Telemetry

97

96

#### **MÜNCHEN**

University of Applied Sciences München

Car 213 Pit 44-B WRL 54

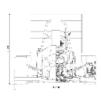
Germany



PassionWorks - not only the name of our cars but also our essential guiding principle! After a one-year break, we are finally back with more power and energy than ever before. Not even one part was left the same after revising our cars from the past. We are confident that our solutions make us more efficient, lighter and faster. Our new car combined with a strong team is fundamental to improve upon the past seasons and will surely let us set new personal records.









FRAME CONSTRUCTION Monocoque / Tubular Space

MATERIAL CFRP. Rohacell Foam Core / 15CrMoV6

**OVERALL L / W / H** 2891mm / 1410mm / 1194mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 115kg / 119kg **SUSPENSION** Double unequal lenght A-Arm, Pullrod actuated, separate roll and heave Spring and Damper

TYRES (Fr / Rr) 205/470 R13, Continental C18 WHEELS (Fr / Rr) 7x13, 30mm offset, CFRP rim with topo-

ENGINE KTM 450 SX-F

BORE / STROKE / CYLINDERS / DISPLACEMENT

95mm / 63,4mm / 1 cylinder / 449 COMPRESSION RATIO 13.95:1

**FUEL SYSTEM** dead-end system, self-developed casted fuel rails, two Bosch EV14 injectors

FUEL E85

MAX POWER/TORQUE DESIGN 9000 rpm/ 7000rpm DRIVE TYPE chaindrive 428# chain, 4-speed gearbox

DIFFERENTIAL Drexler, clutch pack limited slip, adjustable

COOLING custom core water and oil radiators mounted at rear of the car, push fans

BRAKE SYSTEM four X20Cr13 hub mounted floating rotors, AP Racing calipers, adjustable balance bar **ELECTRONICS** MoTeC M150, self developed BMS and
Mainpower, selfdesigned Live-Telemetry, TC, LC, AU...

#### **NAPOLI**

Car 222 Pit T-59 **WRL 398** 



The "UniNa Corse Squadra Corse Federico II" was founded in 2010 and debuted in FSAE Italy with his first car in 2015. This year the team joins his first foreign event with the partecipation at FSG 2018. The 2018 car, improves the performance, rielability and lower the weight of the previous car. His goal for this season is to complete all the dynamic events.











MATERIAL AISI 4130 round tubing (from 16mm to 32mm

OVERALL L / W / H 2945mm / 1485mm / 1270mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 145kg / 161kg SUSPENSION Double unequal A-Arms. Pull Rod actuated oriented spring and damper

TYRES (Fr / Rr) 180/530-13 Pirelli/ 180/530-13 Pirelli

WHEELS (Fr / Rr) 7x13, 22mm offset, Aluminum Rim / 7x13, 22mm offset, Aluminum Rim ENGINE Honda CB600F 2007

BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 12:1  $\textbf{FUEL SYSTEM} \ \mathsf{SMPFI} \ \mathsf{-} \ \mathsf{Sequential} \ \mathsf{Multipoint} \ \mathsf{Fuel} \ \mathsf{Injection}$ 

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 11000 rpm/ 7500rpm DRIVE TYPE Chain: length 776 mm, model 520 **DIFFERENTIAL** Clutch Pack LSD, adjustable preload

through ring nut.

COOLING Side mounted 300 x 315 x 40 core aluminium radiator, 466 cfm fan mounted to rear side.

Steel floating drilled bral

BRAKE SYSTEM 4-Disk system, Steel floating drilled brake

**ELECTRONICS** Gear and shift indicator, Electropneumatic

#### **PADERBORN**

**University of Paderborn** 

Pit T-50

**WRL 51** 



Since 12 years, the passion for engineering and motorsports attracts students from various faculties of the University of Paderborn to join the UPBracing Team. This season 46 students, diving into five departments, make up the team. Besides typical aims like minimizing the weight, increasing downforce and more power we focused on a good driveability to enable our driver to go faster.









FRAME CONSTRUCTION One-Piece CFRP Monocoque MATERIAL Full CFRP with Aramid Honeycomb **OVERALL L / W / H** 2882mm / 1470mm / 1174mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 130kg / 146kg SUSPENSION double unequal wishbone pushrod suspensi-

TYRES (Fr / Rr) Hoosier R25B 18,0x7,5 - 10 / Hoosier R25B

WHEELS (Fr / Rr) CFRP Rim, 10"diameter, 7"width / CFRP ENGINE Suzuki GSX-R 600

BORE / STROKE / CYLINDERS / DISPLACEMENT **COMPRESSION RATIO 13,0:1** 

FUEL SYSTEM Student made tank and fuel rail with Bosch FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 9500 rpm/ 6500rpm DRIVE TYPE chain drive 22,5mm

**DIFFERENTIAL** Drexler Formula Student limited slip

COOLING one coolant on each side of the car without

BRAKE SYSTEM 4-disk system with self developed rotors and driver-adjustable brake balance

**ELECTRONICS** self made cockpit display with LED-shifting

#### **PADOVA**

**University of Padova** 

car with an efficient testing phase.

Car 285 Pit 35-B

WRL 143

since 2003. This year the team is coming back to Formula Student Ger-

many with its 13th car, starting from the experience of the good project

of last year. All the components are designed to be as light as possible

and to reach the best integration in the car. The goal of this year is to

improve reliability and to gain the maximum performance from the new









FRAME CONSTRUCTION Tubolar spaceframe MATERIAL Steel AISI4130 (25CrMo4)

OVERALL L / W / H 2998mm / 1446mm / 1199mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) kg / kg  $\textbf{SUSPENSION} \ \, \textbf{Double unequal length A-Arm. Pull-rod}$ 

**TYRES (Fr / Rr)** 20.5 x 7.0 R13 Hoosier / 20.5 x 7.0 R13

WHEELS (Fr / Rr) 7.0 x 13" / 7.0 x 13" OZ Racing magnesi-

**ENGINE** Honda CBR 600 RR PC40 2007/2008 BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO

FUEL SYSTEM Single injector per cylinder, low pressure FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN rpm/ rpm DRIVE TYPE

DIFFERENTIAL Limited slip, 15 Nm Preload, 51% drive -

**COOLING** Left mounted 30 core aluminum radiator , 1200

BRAKE SYSTEM ISR calipers, 4 self developed rotors with 250mm / 220mm diameter, adjustable brake bias

ELECTRONICS Multifunctional steering wheel, electrop-

clutch and shifting system

FRAME CONSTRUCTION Turbular steel space frame

**OVERALL L / W / H** 2915mm / 1400mm / 1213mm

#### **PFORZHEIM**

Pforzheim University

Car 379 Pit T-64 WRL 309

about 50% more downforce compared to our RSP17 Onyx.

Germany



Rennschmiede Pforzheim presents RSP18 Ruby. Our 6th race car stands for a strong ambitious team bigger than ever. With the organizational structure of a company we where able to design, manufacture and test the RSP18 faster than ever before. Our goal is to build a reliable and cost efficient car. We did some major changes on our standard motor as well as enlarging our aerodynamic device. We decreased the weight and got









MATERIAL E355 from 25x2,5 to 20x1

WHEELS (Fr / Rr) 6.5x10 ENGINE KTM SX-F 450

BORE / STROKE / CYLINDERS / DISPLACEMENT 95mm / 63.4mm / 1 cylinder / 449cc

COMPRESSION RATIO 13,6 FUEL SYSTEM Welded aluminium fuel tank

FUEL E85 MAX POWER/TORQUE DESIGN 9400 rpm/ 7500rpm

DRIVE TYPE chain drive 520 chain

**DIFFERENTIAL** Drexler limited slip differential

**COOLING** Two side pot mounted radiator, two fans each **BRAKE SYSTEM** Self designed, drilled and floating rotors with 182mm Diameter, ISR Brake calibres

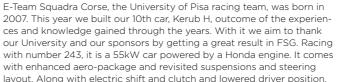
**ELECTRONICS** Multifunctional Steering Wheel, Electrop-

#### **PISA**

**University of Pisa** 















FRAME CONSTRUCTION Tubular steel space frame MATERIAL AISI 4130 round tubing (19.05mm to 28.58mm) **OVERALL L / W / H** 3067mm / 1428mm / 1172mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 148kg / 160kg SUSPENSION Double unequal length A-Arm. Push rod (front) and pull rod (rear)

WHEELS (Fr / Rr) 7"x13", 43mm offset, 1 pc Al-Mg Rim

TYRES (Fr / Rr) 13" - 180mm/530mm, DSS, Pirelli

ENGINE Honda CBR 600RR, 2003 BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO 13:1** 

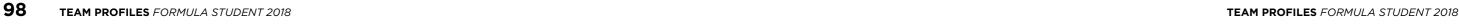
FUEL SYSTEM 2003 Honda CBR 600RR, PC37 FUEL 98 octane unleaded gasoline MAX POWER/TORQUE DESIGN 11500 rpm/ 9900rpm

DRIVE TYPE 520 chain, 15.875mm pitch DIFFERENTIAL LSD, 30-35Nm preload after initial run in, amp angle setup 40deg/50deg

**COOLING** Twin side pod mounted radiators with electric

BRAKE SYSTEM Self developed, inox, floating 230mm (front), fixed 210mm (rear), driver adj. balance bar **ELECTRONICS** Self developed PDU and A2CAN, Electric shift and clutch, GSM based Telemetry





#### **PLZEN**

Car 260

Pit 44-C **WRL 44** 

Czech Republic



The UWB Racing Team Pilsen from the University of West Bohemia consists of 25 team members. We present to you our 5th generation formula student car UWB05. This car is equipped with a new shift system which is operated by gas, new 4-speed gearbox, and a front/rear DRS system. The main goals of our design were a lightweight car and improved aerodynamic downforce balance between the front and rear axles.







FRAME CONSTRUCTION Steel spaceframe

MATERIAL AISI 4340

OVERALL L / W / H 2449mm / 1422mm / 1185mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 140kg / 153kg **SUSPENSION** Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) Hoosier 18.0 x 7.5-10 - R25B

WHEELS (Fr / Rr) OZ Racing Magnezium shell wheel 10

ENGINE Yamaha/YZF-R6 - 2013

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

**COMPRESSION RATIO** 13.7:1 FUEL SYSTEM Dual injection

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 11000 rpm/ 7000rpm **DRIVE TYPE** Sequential 4-speed gearbox

**DIFFERENTIAL** Drexler ES2010

WHEELBASE / TRACK (Fr / Rr)

COOLING Side mounted core aluminium radiator, with

BRAKE SYSTEM ISR 22-048-OB - four pistons **ELECTRONICS** AIM MXS,Transmission Control Unit, Tele-

#### **POZNAN**

**Poznan University of Technology** 

Car 223 Pit T-69 WRL 154



That is the 4th year PUT Motorsport has been representing Poznan University of Technology. Their newest project, Maria, is a sound evolution of the previous one. Their goal was to improve the construction basing on data collected during more than 800 km of testing - this allowed the team to design a mature, well-thought car that will never give up. Thanks to development of composite materials and topological optimization the car jumped to the next level of performance, sliming down below 200 kg.









**FRAME CONSTRUCTION** Hybrid; cut and fold monocoque (front) and steel space frame (rear)

MATERIAL 2 types of aluminium honeycomb core with carbon fibre skins(front); AISI 4130 steel (rear) **OVERALL L / W / H** 2832mm / 1370mm / 1150mm

WEIGHT WITH 68kg DRIVER (Fr / Rr) 92kg / 103kg SUSPENSION 5-link; pushrod-actuated Ohlins TTX25 dam-

TYRES (Fr / Rr) 18.0x7.5-10 Hoosier R25B / 18.0x7.5-10

WHEELS (Fr / Rr) Own-design carbon fiber rims, 7,25

ENGINE Modified Honda CBR600RR (PC40) BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc

COMPRESSION RATIO 13:1 **FUEL SYSTEM** Multi-point injection, Denso 200ccm injectors, Walbro GSL392 pump, ECU controlled

FUEL 98 octane unleaded gasoline MAX POWER/TORQUE DESIGN 12700 rpm/10375rpm **DRIVE TYPE** Chain drive

**DIFFERENTIAL** Locked differential changeable with Drex-LSD with preload adjustment

**COOLING** Left side mounted 340x245mm core aluminum radiator, 1300cfm fan mounted to rear of radiator **BRAKE SYSTEM** 4-disk system, self-developed rotors with 200 (F) and 184 (R) diameter, ISR calipers

**ELECTRONICS** Traction control, launch control, pneumatic clutchless gear shifting system

#### REGENSBURG

Ostbayerische Technische Hochschule Regensburg

Car 262

Pit T-78 WRL 41



An era is going to end! It's the last time we'll have only one car. For this season, we awoke a beast, which is wild, hard to tame and it's BLACK! With hard work, men- and womenpower we found a way to control and improve it, in form of a new Powertrain and a further improved aerodynamic package to be prepared for the upcoming competitions. But there is more! Our beast will get a little brother, not so loud and angry but way faster and good for our carbon foodprint...









FRAME CONSTRUCTION Full CFRP monocoque MATERIAL CERP: twill prepred had UD prepred: Aluminium OVERALL L / W / H 2950mm / 1410mm / 1193mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 92kg / 100kg SUSPENSION Double unequal length A-Arm. Pushrod actuated horizontally oriented spring & damper

TYRES (Fr / Rr) 205/470 R13 C18 Slick Continental WHEELS (Fr / Rr) 7.0x13.0 Self developed CFRP rim

ENGINE Modified Honda CBR 600RR (PC40) BORE / STROKE / CYLINDERS / DISPLACEMENT COMPRESSION RATIO 13 3:1

FUEL SYSTEM CFRP fuel tank with pressure controlled electric pump; intake-manifold fuel injection FUEL 98 octane unleaded

MAX POWER/TORQUE DESIGN 10500 rpm/ 9000rpm DRIVE TYPE AFAM 3D chain 520 MX

self designed semiactive limited DIFFERENTIAL slip, quick adjustment

COOLING two sidepod mounted radiators with PWM controlled waterpump and fan BRAKE SYSTEM Floating, hub mounted, 222mm D, 166mm

**ELECTRONICS** self developed Main Controll Unit, Data Logger, Live Telemetry, ETC

#### **SCHWEINFURT**

University of Applied Sciences Würzburg-Schweinfurt

Car 297

Pit 41-B

**WRL 155** 

Germany









FRAME CONSTRUCTION Tubular space frame MATERIAL F235+C

OVERALL L / W / H 3040mm / 1456mm / 1162mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 145kg / 145kg SUSPENSION Double Wishbone

TYRES (Fr / Rr) 18.0x7.5-10, Hoosier R25B WHEELS (Fr / Rr) 7.0x10, 22mm offset, 1 pc Mg Rim

ENGINE 2003 Yamaha YZF-R6 RJ 05 with FZ6 camshafts BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO** 13.4:1

FUEL SYSTEM Student des. dual stage sequential injection (Bosch valve+pump), MoTec M800
FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 8500 rpm/ 8000rpm DRIVE TYPE D.I.D. 520 ERV3 Motorcycle Racing Chain DIFFERENTIAL limited slip differential (Drexler) 50Nm **COOLING** Two side mounted radiators with electric fans **BRAKE SYSTEM** 4-Disk system, floating self developed brake rotors, front: 4pistons, rear: 2pistons

**ELECTRONICS** electrified shifting, multifunctional steering wheel, datalogger, self design life teleme

FRAME CONSTRUCTION Steel pipe space truss structure

MATERIAL 4130(30CrMo) steel pipe. A30302 OVERALL L / W / H 2960mm / 1440mm / 1180mm

WEIGHT WITH 68kg DRIVER (Fr / Rr) 130kg / 158kg

Rr) rod actuated horizontally oriented spring an

SUSPENSION Double unequal length A-Arm.push(Fr)/Pus-

TYRES (Fr / Rr) 152x67 R10, Hoosier R25A/ 203x50 R10,

WHEELS (Fr / Rr) 6.0x10, 1.67mm offset, 3 pc Al Rim / 8.0x10, 2.44mm offset, 3 pc Al Rim

BORE / STROKE / CYLINDERS / DISPLACEMENT

 ${\bf FUEL\ SYSTEM}$  The injector, pump, fuel rail are from the original car , student built fuel tank

WHEELBASE / TRACK (Fr / Rr)



#### SHIYAN

**Hubei University of Automotive Technology** 

Car 329 Pit T-85 WRL 196

team in china.

Car 228

ST. PETERSBURG

Peter the Great St. Petersburg Polytechnic University



Dongfeng HUAT Racing Team has won the national championship in 2012 and 2015 Formula Student of China Internationally Our Team has participated in Formula Student Germany in 2013 and 2016, the Formula Student Japan in 2014 and 2017,refreshed Chinese teams'best records in the tournaments. Given that Dongfeng HUAT Racing Team was established in 2011, Dongfeng Trucks has provided great supports on the funds,techniques,and management in order to build a world class racing







ENGINE Honda CBR600RR

COMPRESSION RATIO 12 2:1

BRAKE SYSTEM 4-Disk System,self developed rotors with Smmrear diameter

ELECTRONICS wiring harness ,MoTeC M800 control unit,P-



Russia

FRAME CONSTRUCTION Front and rear Tubular space

MATERIAL 1024 steel round tubing, 25x1,5mm, 25x2mm,

**OVERALL L / W / H** 282mm / 1352mm / 1252mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 117kg / 143kg **SUSPENSION** Double unequal length A-Arm. Through bell cranks push/pull rod actuated spring and damper

TYRES (Fr / Rr) 150x75 R10, Hoosier R10 / 150x75 R10,

WHEELS (Fr / Rr) 6.0x10, 25mm offset, 3 pc Al Rim / 6.0x10, 25mm offset, 3 pc Al Rim ENGINE KTM 505 SX-F modified from carburetor to inje

BORE / STROKE / CYLINDERS / DISPLACEMENT 100mm / 60mm / 1 cylinder / 471cc

**COMPRESSION RATIO** 12,5:1

**FUEL SYSTEM** Stud.upgr. Ecortons"400cc to800cc Small Engine Fuel Inject.Kit"fuel sys sequent. FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 10500 rpm/ 5000rpm

DRIVE TYPE Chain DID 520 **DIFFERENTIAL** Drexler Mechanical limited slip differential

COOLING Left side pod munted radiator with electric fan **BRAKE SYSTEM** 4-Disk system, self developed rotors with 190mm outer diam, adjustable brake balance

**ELECTRONICS** DASH 2 PRO Race Technology.Power Dis-





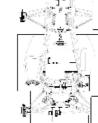


#### **STRALSUND**

**University of Applied Sciences Stralsund** 

Car 318 Pit 34-C WRL 169

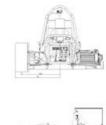
Germany



As the first German Formula Student team, we - Baltic Racing - have shaped the FSG and ever since participated in the competition. Over the last years and only with the amazing help of our sponsors, alumni and supporters we have grown strongly as a team and can now proudly participate with our 18th car - the TY18. After many successful years we are now striving for the Top20 once again!







FRAME CONSTRUCTION Tubular space fram MATERIAL 25CrMo4 OVERALL L / W / H 2750mm / 1455mm / 1070mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 121kg / 132kg **SUSPENSION** double unequal length, nonparallel A-Arms; pull rod actuated; KW Competition 3A

TYRES (Fr / Rr) 205/470 R13, carbon black based, Conti-

WHEELS (Fr / Rr) magnesium cast, 7x13 wheel

ENGINE 2013 Street Triple 675 BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO 12.7:1** FUEL SYSTEM Original fuel injection system using EcuMas-

FUEL gasoline

MAX POWER/TORQUE DESIGN 8500 rpm/ 6000rpm DRIVE TYPE Chain #520 MAD6

DIFFERENTIAL torque biasing Torsen B (Quaife), selfmade 7075 T6 hard-anodized housing

COOLING leftside mounted 1 core aluminium radiator, 1354 cfm fan mounted to radiatorframe

BRAKE SYSTEM 4-disk system, self developed rotors with

d=200mm, t=3, X46Cr13, adjustable balance bar **ELECTRONICS** Electrical shifting system+clutch, self

**STUTTGART University of Stuttgart** 

Car 229 Pit 40-C WRL 1

Germany



We - the Rennteam Uni Stuttgart - are very proud to be part of the Formula Student Germany for the thirteenth time now. After making the podium for 6 years in a row but never quite reaching first place we are more eager than ever to succeed this year! To prevail against the strong competition we focused on our aerodynamic package with attention on manufacturing quality, new lightweight concepts and a well rounded and extensively tested vehicle setup. Complete - Finish - Win!









FRAME CONSTRUCTION Singlepiece Monocoque with

MATERIAL CFRP Sandwich Monocoque, steel rearframe **OVERALL L / W / H** 3044mm / 1435mm / 1195mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 118kg / 128kg **SUSPENSION** Double unequal length A-Arms, pushroad actuated KW damper, adj. T-ARB, heave-spring/damper

TYRES (Fr / Rr) 10x75 - 18 R25B Hoosier WHEELS (Fr / Rr) 10x7.5 - 18 R25B Hoosier

ENGINE Modified Yamaha YZF-R6 BORE / STROKE / CYLINDERS / DISPLACEMENT 65,5mm / 44,5mm / 4 cylinders / 599cc

**COMPRESSION RATIO** 14.87:1 FUEL SYSTEM student build fuel injection system using

FUEL E85 MAX POWER/TORQUE DESIGN 9000 rpm/ 7500rpm

DRIVE TYPE Sequential 4-speed gearbox **DIFFERENTIAL** Drexler limited slip

**COOLING** side mounted core dual radiator , fan mounted to back of each radiator

BRAKE SYSTEM 4-Disk system, adjustable brake balance,

**ELECTRONICS** digital multifunctional Steering wheel, self

#### **THESSALONIKI**

Aristotle University of Thessaloniki

Car 312 Pit T-68 WRL 107



Aristotle Racing Team (ART) was founded in 2006 by a group of mechanical engineering students in Aristotle University of Thessaloniki . The 18 members of the team constructed the race car ART18, the 6th car of the team. ART18 is going to participate in three FSAE competitions, FSAE Italy, FS East and FS Germany. Having gathered knowledge and experience over the past years, the team is aiming higher than ever, trying to surpass past achievements and surpass its limits.









FRAME CONSTRUCTION Steel Spaceframe MATERIAL 4130 Steel Tubing 12.7 to 30mm dia, Sheet metal 4130 and Domex 700

**OVERALL L / W / H** 2978mm / 1394mm / 1188mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 143kg / 148kg SUSPENSION Double unequal length A-Arm. Pull Rod actuated. Spring and damper placed on the side TYRES (Fr / Rr) 20.5x7.0 R13, Hoosier R25B / 20.5x7.0 R13,

WHEELS (Fr / Rr) 7.0x13, 32mm Offset, 1 piece Mg Rim / 7.0x13, 32mm Offset, 1 piece Mg Rim

ENGINE Honda CBR 600cc RR (PC 40)

BORE / STROKE / CYLINDERS / DISPLACEMENT

**COMPRESSION RATIO** 12.2:1 FUEL SYSTEM Student Designed/Built primary

**FUEL** Gasoline

MAX POWER/TORQUE DESIGN 10500 rpm/ 8500rpm DRIVE TYPE Chain 520 X-ring, 4-speed gearbox **DIFFERENTIAL** Drexler Limited Slip clutch type, Bias Ratio 3.082:1 power-side, 25 Nm preload

**COOLING** Side mounted radiator, 37 degrees inclination, two electric fans, mounted in shroud, electric pump **BRAKE SYSTEM** Fully floating ISR discs, 230mm front, 220mm rear, hub mounted, ISR calipers

**ELECTRONICS** Custom built data logger and telemetry

#### **ULM**

University of Applied Sciences Ulm

Car 244

Pit 46-B WRL 191

Einstein Motorsport was founded in 2006. Actually there are about 50

active members in the team. The first car ever built by students from the

University of Applied Sciences Ulm started at Hockenheim in 2006, since

then we developed 11 Formula Student cars. Our newest prototype is the

AL18. AL stands for Albert, in relation to Albert Einstein, who was born

in Ulm. Starting with the Al'06 every car was a continuous development.

Our AL18 is the most innovate and lightest car we ever built.

Germany





**ENGINE** KTM 450 SXF single cylinder Bj. 2018 BORE / STROKE / CYLINDERS / DISPLACEMENT 95mm / 63,4mm / 1 cylinder / 449cc

WHEELS (Fr / Rr) FSAE Mg CAST 7x10 Wheel

FRAME CONSTRUCTION Monocoque, horizontal sepa-

MATERIAL CERP with ROHACELL Foam (variable thick-

**OVERALL L / W / H** 2948mm / 1460mm / 1182mm

WEIGHT WITH 68kg DRIVER (Fr / Rr) 119kg / 124kg **SUSPENSION** Double unequal length A-Arms. Pull rod actuated vertically orientated spring and damper

COMPRESSION RATIO 12.75:1

WHEELBASE / TRACK (Fr / Rr)

FUEL SYSTEM Student built, low pressure fuel system,

FUEL gasoline

TYRES (Fr / Rr) 18 x 6.0 R10

MAX POWER/TORQUE DESIGN 8500 rpm/ 5000rpm DRIVE TYPE chain drive (520 pitch)

**DIFFERENTIAL** Drexler limited slip differential

**COOLING** one radiator is mounted n the right side of the oque one fan is used

BRAKE SYSTEM Floating, water cutted iron, hub mounted, 191mm outer diam., 135mm inner diam.

ELECTRONICS Traction control, Launch control, Automatic

FRAME CONSTRUCTION Front monocoque / rear tubular

MATERIAL Carbon Fiber prepreg, aluminum honeycomb core/high grade steel round tubing

OVERALL L / W / H 2978mm / 1446mm / 1195mm

#### VALÉNCIA

Universitat Politécnica de Valéncia

Car 395 Pit T-70 WRL 117

This is the fifth season for the FSUPV Team in Formula Student and new

objectives have been established in order to obtain big competition re-

sults: weight reduction, go testing to get useful data from every kilome-

ter ran and make the car reliable and easy to drive. According to these

also has been improved the aerodynamic interaction between elements.

ideals, this year the suspension has redesigned to fit 10in wheels and





WEIGHT WITH 68kg DRIVER (Fr / Rr) 116kg / 157kg SUSPENSION Double unequal length A-arm. Pushrod horizontally spring and damper TYRES (Fr / Rr) 18 x 75 - 10 R25B Hoosier

WHEELBASE / TRACK (Fr / Rr)

WHEELS (Fr / Rr) 8.0x10, 25.2mm offset, 3 pc Al Rim

ENGINE 2006 Honda CBR 600 RR BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / COMPRESSION RATIO 12.0:1

FUEL SYSTEM Student des/built, fuel injection FUEL 98 octane

MAX POWER/TORQUE DESIGN 10100 rpm/ 8000rpm DRIVE TYPE 520 x-ring chain

DIFFERENTIAL Limited slip, 30-35 Nm preload, torque

**COOLING** One radiator with single electric fan BRAKE SYSTEM 4-Disk system, self developed rotors with adjustable brake balance

**ELECTRONICS** Traction Control, Full Throttle Shifting,



**FH Campus Wien** 

WIEN

Pit T-53

**WRL 348** 

Our CR118 looks like an old school racing car, but in its heart, it is full with state-of-the-art technology. Consisting of a weight optimized steel tube frame, efficient CFRP aeropackage and a 4-cylinder ic-engine, it represents perfectly the gain of knowledge the team experienced in the last years. Over 40 students of various departments worked hard to present you, for the first time at FSG, the CR118 Johnny - the 5th racing car built at UAS Vienna.









FRAME CONSTRUCTION Tubular Steel Spaceframe MATERIAL S355 steel tubing with different wallthicknesses **OVERALL L / W / H** 2943mm / 1434mm / 1199mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 122kg / 156kg SUSPENSION Double A-Arm & push rods: cfk tubes with aluminum connections, pull based anti roll system

TYRES (Fr / Rr) 205x470 R13, Continental C17 / 205x470

WHEELS (Fr / Rr) 7x13 OZ 4H Magnesiums Wheels / 7x13 OZ 4H Magnesiums Wheels ENGINE Honda CBR 600 RR PC40

BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 12.2:1 FUEL SYSTEM sequential multipoint injection with sequential (one coil per cylinder) ignition

FUEL 98 octane unleaded gasoline MAX POWER/TORQUE DESIGN 11500 rpm/ 9000rpm

DRIVE TYPE 520 chain drive, unmodified PC40 gearbox **DIFFERENTIAL** Drexler differential formula student version

COOLING Left Hand Side mounted 25mm core AKG radiator, 932 cfm fan mounted to the radiator

BRAKE SYSTEM 4-disk system, self made rotors 220mm diam, adjustable brake balance, AP-Racing Calipers **ELECTRONICS** electropneumatic shifting system, multifunvheel, twisted alum. harness





#### **WIESBADEN**

University of Applied Sciences RheinMain

Car 365 Pit T-60 WRL 250

Germany



The Scuderia Mensa Racing Team is proud to present their eleventh Formula Student car, SPR18. The team counts 40 students from various courses of studies. The SPR18 is an improvement of the SPR17. We made small changes in our powertrain and bodywork to save weight.













FRAME CONSTRUCTION Singlepiece Monocoque with

MATERIAL CFRP Monocoque, steel rear frame

OVERALL L / W / H 2901mm / 1411mm / 1197mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 111kg / 136kg **SUSPENSION** Double unequal length A-Arm Pushrod actuated, horizontally oriented spring and damper

TYRES (Fr / Rr) Hoosier 6.00x18 R10 R25B

WHEELS (Fr / Rr) OZ 7x10

ENGINE KTM LC4 690

BORE / STROKE / CYLINDERS / DISPLACEMENT

COMPRESSION RATIO 12,4:1

FUEL SYSTEM Fuel injection

FUEL 98 octane

MAX POWER/TORQUE DESIGN 8200 rpm/ 6800rpm

DRIVE TYPE chain drive (D.I.D. 520 ert2)

DIFFERENTIAL Drexler LSD

COOLING Diffusor mounted radiator

BRAKE SYSTEM 4-Disk system

**ELECTRONICS** Self developed PCB for data logging and live telemetry, modular wiring harness

#### **WROCŁAW**

Wrocław University of Technology

Car 309 Pit 38-B WRL 16





PWR Racing Team is proud to present their ninth Formula Student car - RT09. Today the team counts 60 team members, who are divided into six departments. In 2017 for the first time in polish history we won the whole Formula Student competition - FSAE Italy. We also won Acceleration event for the second year in row. In RT09 aerodynamics package has been upgraded, we've made telemetry system and we've implemented graphical 4.3' display built in steering wheel.











WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 120kg / 131kg **SUSPENSION** SLA type, pushrod actuated, adjustable U-bar, 4-way adjustable dampers, coil springs TYRES (Fr / Rr) F/R: 18.0x7.5-10, Hoosier R25B

ENGINE Modified Honda CBR600RR PC40 BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc COMPRESSION RATIO 12,2:1

WHEELS (Fr / Rr) 8,2x13 Aluminum / 8,2x13 Aluminum

FUEL SYSTEM MoTeC M130 Denso 1060, multi point injecti-

FUEL 98 octane unleaded gasoline

MAX POWER/TORQUE DESIGN 11000 rpm/ 9000rpm DRIVE TYPE 520 non-oring chain, 4 gear gearbox

DIFFERENTIAL Drexler LSD, 30% lock COOLING left side mounted (H:460 W:230 D:28mm) core aluminium radiator, cfm fan

BRAKE SYSTEM Fully floating, 196mm/169mm dia., thick, steel, machined

**ELECTRONICS** Aerospace grade 28-10AWG wires, 2D and 3D designed wiring, strain relief loops



#### FRAME CONSTRUCTION CFRP Monocoque in sandwich

MATERIAL HTA40 Prepreg, M40J UD Prepreg, Rohacell 51WF foam core, 72kg/m³ 5052 aluminium

**OVERALL L / W / H** 2932mm / 1526mm / 1126mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128kg / 137kg **SUSPENSION** Double A-arm, pushrod, coil springs, KW damper, Z-Anti-Roll-Bar

TYRES (Fr / Rr) Continental C17 205/470 R13

WHEELS (Fr / Rr) 7Jx13, 22mm offset, two piece CFRP/

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / Wheel Hubs /  $33~\mathrm{kW}$ 

MOTOR TYPE PMSM MAX MOTOR RPM 20000

MOTOR CONTROLLER KW26-S5-FSE-4Q MAX SYSTEM VOLTAGE 600V

**ELECTRODE MATERIALS** LiCoO2 COMBINED ACCUMULATOR CAPACITY 8.4

TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE 1.5 staged planetary gearbox **DIFFERENTIAL** electric Torque Vectoring

COOLING Two separate water cooling circuits, one for the motors, one for combined batter/inverter cooling

BRAKE SYSTEM 4-Disk system, self developed rotors with eter, adjustable brake balance

**ELECTRONICS** Agilon telemetry system/self developed



Hochschule Aalen - Technik und Wirtschaft

Car 61 Pit 09-B WRL 60

The seventh car of the E-Motion Rennteam comes along with plenty of

with a new layup to achieve a lighter monocoque with the same stiff-

to meet our first design goal the functional safety. With a redesigned and optimized version of the ERT-06/17 we are pleased to participate at

the FSG. We are looking forward to see you all at the Events!

ness. The electronic components are improved in safety and efficiency

Germany



TYRES (Fr / Rr) Hoosier 6.0/18.0-10 LC0 WHEELS (Fr / Rr) 7.0x10, 20mm offset, center lock mag-

WEIGHT WITH 68kg DRIVER (Fr / Rr) 124kg / 156kg

**SUSPENSION** Double unequal length A-Arm, direct mounted spring and damper

FRAME CONSTRUCTION CFK-Monocoque / steel rear

MATERIAL carbon fibre Tenax HTA 40 IGE foam core

**OVERALL L / W / H** 2846mm / 1411mm / 1132mm

NUMBER OF MOTORS / LOCATION / MAX POWER 2 / Rear right, Rear left / 80kW
MOTOR TYPE Enstroy Emrax 208

MAX MOTOR RPM 6000

WHEELBASE / TRACK (Fr / Rr) 1530mm / 1132mm / 1127mm

MOTOR CONTROLLER Emsiso emDrive H300 MAX SYSTEM VOLTAGE 403V

ELECTRODE MATERIALS LiCoO2

**COMBINED ACCUMULATOR CAPACITY** 8.064kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE TRE mini Tripod, Ford

**DIFFERENTIAL** Torque vectoring control via ECU

**COOLING** Two radiators mounted in the side boxes. BRAKE SYSTEM 4-Disk system, self developed rotors with

191mm diameter, adjustable brake balance

**ELECTRONICS** CAN communication, own telemetry system, self developed AMS, self developed CAN pcb's

#### **AMBERG**

Ostbayerische Technische Hochschule Amberg-Weiden (OTH)

Pit 20-C WRL 6

Germany



The Running Snail Racing Team was established in August 2004 at the OTH Amberg-Weiden in eastern Bavaria. After building eight combustion cars, the "RS18" is our sixth generation electric powered racecar. With further weight reduction, optimized motors and a new aerodynamics package, we hope to be able to surpass last year's results. For further information please visit us on Facebook or our website www.running-snail.de.









#### FRAME CONSTRUCTION Composite CFRP/aluminium

MATERIAL aluminium honeycomb, prepreg CFRP **OVERALL L / W / H** 2945mm / 1451mm / 1183mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 126kg / 137kg **SUSPENSION** Unequal length double wishbone axle . U-type antirollbar. Pushrod/Pullrod on front/rear. TYRES (Fr / Rr) Hoosier 18.0x7.5-10 R25B

WHEELS (Fr / Rr) 7.25x10, 21.4 mm offset,

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE Fischer Elektromotoren, TI085-052-070

MAX MOTOR RPM 16400 MOTOR CONTROLLER Lenze Mobile DCU 60/60

MAX SYSTEM VOLTAGE 600V **ELECTRODE MATERIALS** LiPO, LICoO2 - graphite

COMBINED ACCUMULATOR CAPACITY 7.98kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE planetary gearbox

DIFFERENTIAL N/A

COOLING twin side pod mounted radiator

BRAKE SYSTEM fr. 4 piston; fr. 2 piston; semi-floating, hub mounted, 175mm diameter, adjustable brake ELECTRONICS data logging system, self-designed telemetry, CAN, safety monitoring

**FRAME CONSTRUCTION** Single-piece CFRP monocoque + fully laminated FH + steel roll over protection

MATERIAL HS & IM CF plies +Aluminium core + Aluminium

**OVERALL L / W / H** 2925mm / 1440mm / 1160mm

WHEELBASE / TRACK (Fr / Rr)

#### **BARCELONA**

PT University of Catalonia - Engineering School of Barcelona

Car 54

Pit 25-A WRL 15

FTSFIB Motorsport is a FSF team established in 2007 at Barcelona. Since our foundation, we have developed a new car every year and for this season we are proud to introduce you the CAT11e. With a great basis from last year design, the new CAT keeps on the same philosophy but improves lots of details to achieve the best performance on track. After a year of hard work, the team is willing to see the CAT11e doing its best. Looking for further information about us? Do not hesitate to visit our pit.





Spain





#### WEIGHT WITH 68kg DRIVER (Fr / Rr) 121kg / 148kg **SUSPENSION** Double unequal length A-Arm. Push rod actuated spring and damper. Front and rear ARB TYRES (Fr / Rr) 18x7,5 R10 Hoosier R25B / 18x7,5 R10

WHEELS (Fr / Rr) 7x10, ET35 mm. Laminated carbon fiber rim / 7x10, ET35 mm. Laminated carbon fiber rim

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE Axial flux synchronous permanent magnet

MAX MOTOR RPM 6500

MOTOR CONTROLLER Unitek BAMOCAR D3 700-400 MAX SYSTEM VOLTAGE 600V ELECTRODE MATERIALS LiCoO2

COMBINED ACCUMULATOR CAPACITY 7,1kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Self designed two-stage parallel gearbox **DIFFERENTIAL** Clutch pack limited slip, 10 Nm preload, adjustable bias ratio

COOLING Side mounted self-designed radiator **BRAKE SYSTEM** 4-Disk system, self developed steel rotors with 179mm diameter, adjustable brake balance

**ELECTRONICS** Self-developed BMS, front and rear ECU, live-telemetry and dashoard



Pit 14-A WRL 45

efficient during the construction phase.

Car 99

Ecurie Aix is one of the oldest Formula Student Teams in Germany, founded in the year 2000. The team name is derived from the french words



we switched our team's structure, so we were able to work much more













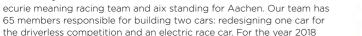








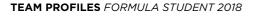




Germany







#### **BERLIN**

Technische Universität Berlin

Car 13 Pit 07-C

Germany



The FT18e will be the first electric vehicle ever built by FaSTTUBe. Therefore, we focused on applying 11 years of IC vehicle experience to the construction of the e-powertrain, chassis and suspension. We do not expect our first electric vehicle to be a first-class car, but we want to lay the foundations for a successful electric future as a solid newcomer. Because the completion of the endurance event heavily influences the relative success of the car, the design is driven by reliability.









FRAME CONSTRUCTION Tubular Steel Frame

OVERALL L / W / H 2653mm / 1441mm / 1114mm

WHEELBASE / TRACK (Fr / Rr)

**SUSPENSION** Double unequal length A-Arm. Push rod actuated spring and damper. Adjustable Z-Anti Roll B

TYRES (Fr / Rr) 205x470-R13, Continental R25B /

MAX SYSTEM VOLTAGE 588

ELECTRODE MATERIALS LiNiCoMnO2 - graphite

TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** planetary gearbox with staged planets

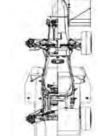
**COOLING** Single serial cooling circuit with two radiators passively cooled, mounted on the back

BRAKE SYSTEM 4-Disk system, self developed and optimized rotors, ISR Calipers, Cockpit adjustable brake **ELECTRONICS** self developed BMS and Multifunctional

#### **BRAUNSCHWEIG**

Technische Universität Braunschweig

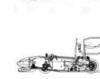
Car 19 Pit 14-B WRL 84



The Lions Racing Team is celebrating its 18th birthday at Hockenheim this year and with the LR18 it will be a wild party. Everyone has worked hard to make this special year count. We achieved a vehicle with a sleek appearance and highly developed accumulator. Let's rock the Endurance and make the FSG 2018 unforgettable!











#### MATERIAL 25CrMo4

WEIGHT WITH 68kg DRIVER (Fr / Rr) 90kg / 123kg

**WHEELS (Fr / Rr)** 7x13, 25 mm offset, 3 pc Al Rim / 7x13,

NUMBER OF MOTORS / LOCATION / MAX POWER 2 / Rear Right, Rear Left / 35
MOTOR TYPE AMK / DD5-14-10-POW

MAX MOTOR RPM 20000 MOTOR CONTROLLER AMK / KW26-S5-FSE-4Q

COMBINED ACCUMULATOR CAPACITY 6,526

DIFFERENTIAL n/a

#### FRAME CONSTRUCTION Monocoque

MATERIAL CFRP laminate with aluminum-honeycomb core **OVERALL L / W / H** 2913mm / 1327mm / 1157mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 146kg / 154kg SUSPENSION Double unequal length A-Arm. Pushrod

TYRES (Fr / Rr) 205 / 470 R13, Continental WHEELS (Fr / Rr) 7x13, 22 mm offset, 1 Pc Al Rim

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE AMK - DD5-14-10-POW

MAX MOTOR RPM 20

MOTOR CONTROLLER AMK - KW26-S5-FSE-4Q

MAX SYSTEM VOLTAGE 600V ELECTRODE MATERIALS Lithium Cobalt Oxide (LiCoO2)

COMBINED ACCUMULATOR CAPACITY 7

TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Planetary gear drive and step planets DIFFERENTIAL Motor at each wheel

**COOLING** Accumulator passive and active air; Motors passive and active liquid; Inverter active liquid cooling BRAKE SYSTEM Steel and aluminium rotors. Generator at each wheel and high peak charge power accumulator

**ELECTRONICS** No LV-Battery; Selfdesigned battery management system, motor control unit and dashboard.

#### **BREMEN**

University of Bremen

Car 72

Pit 17-B WRL 127

Germany



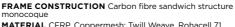
Bremergy is the Formula Student team of the university of Bremen, founded in 2012. With the BreMo 18 we wanted to start a new era of the team. Reviewing the past seasons, we started to create a wholly new car concept. Even the limited possibilities we had to face in several situations, couldn't stop us from building an eye-catching and powerful electric racecar. No doubt, the BreMo 18 is the best car we have ever created. Don't believe us? Then convince yourself!











MATERIAL CFRP, Coppermesh; Twill Weave, Rohacell 71 IG-F Foam core (15mm & 25mm) **OVERALL L / W / H** 2911mm / 1499mm / 1216mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 121kg / 197kg **SUSPENSION** Double unequal length A-Arm. Pull rod actuated vertically oriented spring and damper. Pus

TYRES (Fr / Rr) 18x6 Hoosier R25B WHEELS (Fr / Rr) 10x6.5, 2pc Carbon Rim / 10x6.5, 2pc

NUMBER OF MOTORS / LOCATION / MAX POWER 2 / Rear Right & Rear Left / 80 kW

MOTOR TYPE Enstroj Emrax 207 HV LC MAX MOTOR RPM RR, RL: 6.000 MOTOR CONTROLLER Own design MAX SYSTEM VOLTAGE 432V

**ELECTRODE MATERIALS** LiCoO2 COMBINED ACCUMULATOR CAPACITY 6.9 kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE Planetary Gearbox DIFFERENTIAL n/a

COOLING watercooled motors and motor controller, twin side pod mounted radiators

BRAKE SYSTEM 4-Disk system, floating self developed ble brake balance

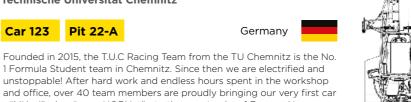
**ELECTRONICS** Self-made ECU, selfdesigned Live-Telemet-

#### **CHEMNITZ**

Technische Universität Chemnitz

Car 123 Pit 22-A

Germany



WHEELBASE / TRACK (Fr / Rr) WEIGHT WITH 68kg DRIVER (Fr / Rr) 149kg / 168kg **SUSPENSION** Double unequal length A-Arms. Pushrod actuated spring/damper TYRES (Fr / Rr) Continental 205/470 R13 WHEELS (Fr / Rr) 7x13, 30 mm offset, OZ Magnesium 4H

FRAME CONSTRUCTION Steel space frame

MATERIAL E235 & E355 precision steel tubes

OVERALL L / W / H 2804mm / 1475mm / 1200mm

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE Emrax 228 HV LC MAX MOTOR RPM 5500

MOTOR CONTROLLER Unitek Bamocar D3 700/400

MAX SYSTEM VOLTAGE 598 **ELECTRODE MATERIALS** LiNiCoAlO2 - graphite

COMBINED ACCUMULATOR CAPACITY 8,96 kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE Chain drive

**DIFFERENTIAL** Drexler limited slip differential with adjus-

**COOLING** Motor and inverter water cooled. Single side

**BRAKE SYSTEM** 4 self designed floating discs, adjustable brake balance, Wilwood GP200 calipers

**ELECTRONICS** ECU from dSpace, self-designed TSAL, designed dash-board for car status visualizat

#### **CLAUSTHAL**

Clausthal University of Technology

Car 142 Pit 10-A WRL 76

1 Formula Student team in Chemnitz. Since then we are electrified and

unstoppable! After hard work and endless hours spent in the workshop

- "MKx. I" a.k.a. "greenHORNet" - to the race tracks of Europe. Now we

are happy joining the Saxonian FS family at FSG. Feel free to meet our

awesome and incredibly devoted engineers in the pit! #madeinsaxony

Germany

We are Green Voltage Racing from Clausthal UT and proud to present this year's vehicle - the GVRacer 7! In comparison to our previous vehicle we dramatically cut down our weight by intensifying work with finite element software, enhancing the cars electronic reliability and error handling system and designing a new 5-link suspension system. We were able to reduce the moment of inertia of the sprocket by 80 % and still increase its output torque to over 940 Nm in contrast to its predecessor.









#### FRAME CONSTRUCTION Steel tube frame MATERIAL Construction steel S355

**OVERALL L / W / H** 2983mm / 1410mm / 1258mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 134kg / 146kg **SUSPENSION** 5-Link with pushrods and horizontal springs in pushrod configuration. All rods adjustable

TYRES (Fr / Rr) 205/470 R13, Continental / 205/470 R13,

WHEELS (Fr / Rr) 7Jx13, OZ Formula Student Magnesium 4H / 7Jx13, OZ Formula Student Magnesium 4H

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE Enstroj EMRAX 228 HV LC

MAX MOTOR RPM 6500 MOTOR CONTROLLER Unitek Bamocar D3

MAX SYSTEM VOLTAGE 600V ELECTRODE MATERIALS LiCoO2

COMBINED ACCUMULATOR CAPACITY 6.4kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** single stage chain gear w/ simplex chain **DIFFERENTIAL** Drexler limited slip differential **COOLING** single-curcuit with 2 radiators for inverter and motor driven by gear pump

BRAKE SYSTEM 4-Disk system, self-developed rotors with 210mm diameter, adjustable brake balance

**ELECTRONICS** self-developed ECUs and AMS, CAN-Bus,

FRAME CONSTRUCTION one-piece monocoque with

#### **DEGGENDORF**

**Deggendorf Institute of Technology** 



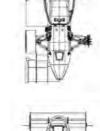
goals of reliability and validation.

Pit 22-B WRL 48

Fast Forest is the Formula Student team of the Deggendorf Institute of Technology, founded in 2008. With this year's season, Fast Forest reaches its 10th year of race car passion and the dedication for new innovations. Therefore, we are proudly introducing Jenny10X, the ninth generation of electric race cars which combines the benefits of its predecessor with new features. The overall concept is based on the two













MATERIAL CFRP prepreg sandwich with aluminium honey-**OVERALL L / W / H** 2873mm / 1361mm / 1162mm WHEELBASE / TRACK (Fr / Rr) WEIGHT WITH 68kg DRIVER (Fr / Rr) 123kg / 134kg **SUSPENSION** double unequal length A-Arm, push rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) 205/407 R13 - Continental C18 WHEELS (Fr / Rr) OZ MGAL 7 x 13 Formula Student

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE 4x AMK DD5-14-10-POW MAX MOTOR RPM 20000

MOTOR CONTROLLER AMK KW26-S5-FSE-4Q MAX SYSTEM VOLTAGE 588V **ELECTRODE MATERIALS** LiCoO2

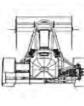
**COMBINED ACCUMULATOR CAPACITY** 6.84kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** planetary gearbox with staged planets DIFFERENTIAL -

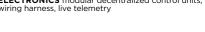
**COOLING** sperated water cooling for left and right motors and for inverter, air cooled battery BRAKE SYSTEM 4-disk system, self developed rotors,

**ELECTRONICS** modular decentralized control units, split wiring harness, live telemetry











#### **DELFT**

**Delft University of Technology** 

Car 85 Pit 04-C WRL 9

Netherlands



The DUT18 is the latest in a long line of successful machines designed and built by Formula Student Team Delft. This season, the team's focus was to optimise the synergy between the car and the driver, which was achieved by specific focus on the ergonomics and aerodynamics of the vehicle. Coupled with the now-traditional 14.5' tyres and custom-designed cooling system, the DUT18 is ready to take on the competition at Hockenheim







FRAME CONSTRUCTION Full monocoque MATERIAL CFRP with aluminum honevcomb core OVERALL L / W / H 2831mm / 1428mm / 1138mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 112kg / 116kg **SUSPENSION** Double unequal length A-Arm. Direct acting spring damper front, pushrod rear

TYRES (Fr / Rr) 225x368-R10, Vredestein

WHEELS (Fr / Rr) 214mm CFRP self-made two-piece rim

NUMBER OF MOTORS / LOCATION / MAX POWER MOTOR TYPE AMK DT5-14-10-POW-14000-B5

MAX MOTOR RPM 20000 MOTOR CONTROLLER AMK KW26-S5-FSE-4Q MAX SYSTEM VOLTAGE 600V

ELECTRODE MATERIALS LiCoO2 **COMBINED ACCUMULATOR CAPACITY** 6.8 kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** 3 Planet single-stage transmission **DIFFERENTIAL** Electronic using own control systems **COOLING** Water cooled with radiator rearward of chassis **BRAKE SYSTEM** Rotor floating in hub, 3 & 2 mm steel, 161/119mm, Integrated caliper half

**ELECTRONICS** Multiple driver aids, Self designed data logging on ECU, UFH Band FHSS protocol telemetry

#### **DIEPHOLZ**

University of Applied Sciences Diepholz/Oldenburg/Vechta

Car 16 Pit 07-A WRL 94

Germany



We are Deefholt Dynamics, the racing team of the PHWT from Diepholz. As part of our stud-ies we participate since 2006 at formula student. The special thing about us: Our car is built every year by a first year team within only six months. This season 47 student's joined the project with one goal: Building a competitive car as fast as no one else can do. So within our long-term concept we optimize our car step by step, year by year. This season, for example, with new aerodynamic devices.











MATERIAL 25CrMo4 **OVERALL L / W / H** 3207mm / 1510mm / 1199mm WHEELBASE / TRACK (Fr / Rr) WEIGHT WITH 68kg DRIVER (Fr / Rr) 165kg / 193kg SUSPENSION Double unequal length A-Arm. Push rod/pull rod with damper bridge on rear axle TYRES (Fr / Rr) Hoosier 18.0 x 6.0 - 10 R25B

NUMBER OF MOTORS / LOCATION / MAX POWER / Rear Right, Rear Left / 40 k\

MOTOR TYPE EMRAX 208 LV LC

MAX MOTOR RPM 5500

MOTOR CONTROLLER Emsiso emDrive 500

MAX SYSTEM VOLTAGE 128V

**ELECTRODE MATERIALS** LiFeYPO4

WHEELS (Fr / Rr) 6.25 in contact oatch

COMBINED ACCUMULATOR CAPACITY 7.68kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE Brushless DC

**DIFFERENTIAL** Electronically controlled torque distributi-

COOLING Two radiators 180x120 mm mounted in sidepods. **BRAKE SYSTEM** self developed floated rotors with 190mm diameter, AP Racing calipers

**ELECTRONICS** selfdesigned Live-Telemetry-System and different driving modes selectable via rotaryswitch

#### **DRESDEN**

Technische Universität Dresden

Car 25

Pit 23-A WRL 23

Germany



We proudly introduce LottE, the already eleventh Racecar in the history of Elbflorace to compete in the Formula Student.60 students from the TU Dresden majoring in a wide variety of studies accomplished to build by far the most lightweight vehicle in club history. Especially our new Monocogue helped us get there. Weighing only 17,5kg including front and main hoop, it fulfills with ease the second-year requirements of our strict 3-year-plan, that is supposed to place us in the Top 5 of FSE this









FRAME CONSTRUCTION full size CFRP Monocoque MATERIAL CFRP with aramid core 15-20mm thick OVERALL L / W / H 2942mm / 1437mm / 1165mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 122kg / 122kg **SUSPENSION** double unequal lenght triangular A-Arm Suspension, double-spring and 4-valve-damper system

TYRES (Fr / Rr) 205x470 R13 Continental C18 WHEELS (Fr / Rr) 7x13, 30mm offset, 1pc Mg Rim

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / Wheel Hubs FL FR RR RL / 35kw per Motor

MOTOR TYPE AMK / DD5-14-POW-19000 MAX MOTOR RPM 20000

MOTOR CONTROLLER

MAX SYSTEM VOLTAGE 560V **ELECTRODE MATERIALS** Lithium-ion Polymer

COMBINED ACCUMULATOR CAPACITY 6.53 KWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** 1.5 stage planetary gear integrated DIFFERENTIAL n/a

COOLING 2 separated closed circulation water cooling systems for motor and inverter BRAKE SYSTEM 4 wheel recuperation, mechanically

**ELECTRONICS** DRS System, driver accessible vehicle via cockpit buttons, torque vectoring

#### **EINDHOVEN**

**Eindhoven University of Technology** 

Car 40 Pit 06-A WRL 35

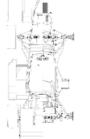
Netherlands

University Racing Eindhoven is the largest student project of the Eindhoven University of Technology. The 2018 competer, the URE13, features four custom URE/AE in-wheel electric motors controlled by a custom URE/Prodrive quad inverter. The power is transferred to the tarmac using custom Vredestein tires while the torque vectoring algorithm distributes torque between the wheels. Finally, the car is complemented with a lightweight aerodynamic package and one of the smallest final drives possible.















4 / Wheelhub mounted / 4X30Kvv MOTOR TYPE URE&AE / Custom-developed PMSM MAX MOTOR RPM 18 MOTOR CONTROLLER Custom guad motorcontroller

FRAME CONSTRUCTION CRFP sandwich full monocoque

MAX SYSTEM VOLTAGE 400V **ELECTRODE MATERIALS** LiCoO2

**COMBINED ACCUMULATOR CAPACITY** 7

TRANSMISSION RATIO (PRIMARY / SECONDARY) DRIVE TYPE In-wheel compounded planetary gearbox

DIFFERENTIAL Electronic torque vectoring differential **COOLING** Side mounted double radiator, water cooled, accumulator airducts and rear mounted electric fans BRAKE SYSTEM Floating, steel hub mounted, 182x3 mm, ented student designed rotors

**ELECTRONICS** IO Nodes, 14 way fusebox settable via CAN, Live telemetry, 300W DC/DC converter

#### GÖTTINGEN

Hochschule für angewandte Wissenschaft und Kunst Hildesheim/ Holzminden/Göttingen

Car 171 Pit 19-B WRL 49

forward to exciting days at FSG 2018.

Germany

Germany

The Team Blue Flash Mobility Concepts was founded in 2015. 35 Students from three faculties of the HAWK Goettingen collaborate in realizing their third race car. In 2017 the team built an exceptionally safe vehicle. For the E\_HAWK18 this unique design was refined and paired with more reliability and increased power. The team stays pioneer in low Voltage technology in the Formula Student competition. We are looking











#### FRAME CONSTRUCTION Front and rear Tubular space MATERIAL S235 +C , S355 +N ; 28x1.2, 26x1.2, 28x2

**OVERALL L / W / H** 3000mm / 1400mm / 1206mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128kg / 130kg SUSPENSION double A-arm, unequal length, Push rod, Spring and Damper horrizontally

TYRES (Fr / Rr) 205/470 R13, Continental C16 / 205/470

WHEELS (Fr / Rr) 7x13, 30mm offset, 1pc Al-MG Rim / 7x13, 30mm offset, 1pc Al-MG Rim NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE EMRAX 208 MAX MOTOR RPM 7250

MOTOR CONTROLLER emsiso EmDrive 500 MAX SYSTEM VOLTAGE 118V

**ELECTRODE MATERIALS** LiPo - Cobalt Oxide COMBINED ACCUMULATOR CAPACITY 7,40kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Spur Gears

**DIFFERENTIAL** none

**COOLING** Two rear mounted self developed radiators **BRAKE SYSTEM** 4-Disk system, self dev. rotors with 207/207mm (f/r) diameter, adj. brake balance

**ELECTRONICS** self design main control unit, self designed battery management system

#### **HAMBURG**

**Hamburg University of Technology** 

Car 78

Pit 06-B WRL 38

The ean18-ev is the seventh car of the e-anition Hamburg Team. We opted for an all-wheel drive, featuring a carbon fibre monocoque, a complete aerodynamic package and a completely improved accumulator system. With our strong team we managed to ensure a community in which everybody helped each other, and through which we got our car out on the testing track by mid may. We are excited to spend a great week with the Formula Student community at a sunny Hockenheim race









FRAME CONSTRUCTION Monocoque structure with prepreg and aluminium honeycomb material MATERIAL IMS65 UD Fibres

OVERALL L / W / H 3000mm / 1400mm / 1130mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 129kg / 133kg **SUSPENSION** Double unequal length A-Arm. Push rod actuated air spring and damper

TYRES (Fr / Rr) Continental C18 WHEELS (Fr / Rr) 13

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / Each Wheelhub / 30kW each
MOTOR TYPE AMK DD5-14-10-POW

MAX MOTOR RPM 21000

MOTOR CONTROLLER AMK Wechselrichter KW26-S5-

MAX SYSTEM VOLTAGE 600V

ELECTRODE MATERIALS LiCoO2 - Graphite **COMBINED ACCUMULATOR CAPACITY** 6.7kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

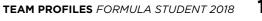
**DRIVE TYPE** One stage planetary gear system in wheel **DIFFERENTIAL** Software actuated electrical differential COOLING Water cooling. Two motors and one motorcon-

BRAKE SYSTEM Self developed rotors with 191mm diame-

**ELECTRONICS** ECU, AMS, IMU and sensor boards self







#### **HANNOVER**

Leibniz Universität Hannove

Car 118 Pit 14-C WRL 63

Germany



HorsePower Hannover e.V. was founded in 2007 by a group of 10 engineering students. Our first events were FSUK and FSG in 2009 with the RacePony09, a combustion racecar. 2011 we build our first electric racecar, the electricHorse11. This year we are competing with an electric all wheel drive racecar at FSG.



concept. Now we are back on track with all-wheel drive, aerodynamics,

3-damper concept and a lot of motivation, ready to surpass the expec-







FRAME CONSTRUCTION single-piece CFRP monocoque MATERIAL CFRP prepreg, aluminium honeycomb OVERALL L / W / H 2960mm / 1438mm / 1181mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 149kg / 155kg SUSPENSION Double A-Arm Push rod actuated TYRES (Fr / Rr) Continental 470/205 R13, C18 slick WHEELS (Fr / Rr) Al Rim, 3pieces, 46mm offset, 7Jx13

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE AMK DT5-14-10-POW MAX MOTOR RPM 20000

MOTOR CONTROLLER AMK KW26-S5-FSE-4Q MAX SYSTEM VOLTAGE 588V

**ELECTRODE MATERIALS** LiCoO2 **COMBINED ACCUMULATOR CAPACITY** 6 TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE 1.5 stage planetary gearbox

**DIFFERENTIAL** programmable

**COOLING** One-cycle water cooling system, two side pod mounted heat exchanger **BRAKE SYSTEM** 4 self developed steel brake discs, 203mm diameter, 4 pistons front, 2 pistons rear

**ELECTRONICS** self designed AMS, wheel acceleration limiter, torque vectoring, traction control

#### **ILMENAU**

**Ilmenau University of Technology** 

tations.

Car 71 Pit 17-A WRL 73



After last year's fire that destroyed our dreams for FSG 2017, we started project phoenix, put all energy into renovating our workshop and regaining the lost equipment. Thanks to the support from our sponsors and fellow FS teams we were able to recover from the severe setback and embraced the opportunity to start all over again with a completely new









#### FRAME CONSTRUCTION Monocoque

MATERIAL CFRP Sandwich

**OVERALL L / W / H** 2790mm / 1481mm / 1050mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 125kg / 121kg

SUSPENSION Double equal length A-Arm. Push rod actuated horizontally oriented spring and damper. TYRES (Fr / Rr) 205x34 R13, Continental C17 / 205x34 R13,

WHEELS (Fr / Rr) 7x13, OZ FSAE Mg / 7x13, OZ FSAE Mg

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE AMK DD5-14-10-POW-18600-B5

MAX MOTOR RPM 20000

MOTOR CONTROLLER in-house developed SiC inverter MAX SYSTEM VOLTAGE 600V

**ELECTRODE MATERIALS** LiCoO2 - graphite

**COMBINED ACCUMULATOR CAPACITY** 10

TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** planetary gear set

DIFFERENTIAL n/a

**COOLING** 2 cooling circuits linked by compensator reservoir, cooling 2 motors and 2 inverters each

BRAKE SYSTEM 4-Disks, self-dvlp rotors: dia 216 (frnt) & 205 (rear), adjust. brake balance

**ELECTRONICS** 2 CAN buses, in-house developed AMS,

#### **INGOLSTADT**

**Technische Hochschule Ingolstadt** 

Car 34

110

Pit 06-C WRL 67

Germany



Schanzer Racing Electric was founded in 2010 and took part in FSG in 2012 for the first time. Schanzer Racing is a team of 70 students of the TH Ingolstadt. The Team will participate for the 7th time in the FS Germany. We proudly join the competition with our new electric car the SRe18. This year we are proud to present: a improved CFRP chassis, 4WD and the new aerodynamics. We are looking forward to a great season with all of you - especially the Rennteam Aalen and Fast Forest Deggendorf.











FRAME CONSTRUCTION Full carbon fibre monocoque

MATERIAL CFRP. Rohacell

OVERALL L / W / H 2831mm / 1479mm / 1195mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 148kg / 155kg

**SUSPENSION** Double unequal length A-Arm. Push rod actuated horizontally oriented spring and damper (co TYRES (Fr / Rr) Continental, 205/470 R13

WHEELS (Fr / Rr) 7x13, 30 mm offset, 1 pc Mg Rim

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / Front Right, Front Left, / 35 kW per motor

MOTOR TYPE AMK DD5-14-10-POW

MAX MOTOR RPM 20000

MOTOR CONTROLLER AMKASYN Inverter KW26-S-FSE4Q

MAX SYSTEM VOLTAGE 350 ELECTRODE MATERIALS LiNiCoAl02 **COMBINED ACCUMULATOR CAPACITY 7,78** 

TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE Gear Box

**DIFFERENTIAL** through Torque Vectoring COOLING watercooled, 2 lateral to the monocogue moun-

BRAKE SYSTEM 4-Disk system, self developed rotors with

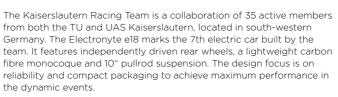
**ELECTRONICS** CAN-to-WLAN live telemetry; decentral CAN PCBs; IP67 wiring

#### KAISERSLAUTERN

Kaiserslautern University of Technology

Car 64 Pit 12-B WRL 53

Germany















orepreg, Aluminium honeycomb sandwich

WHEELBASE / TRACK (Fr / Rr)

MOTOR TYPE KaRaT/VSM AFW507D

FRAME CONSTRUCTION Single piece monocoque, tubular

MATERIAL Carbonfibre twill weave and unidirectional

WEIGHT WITH 68kg DRIVER (Fr / Rr) 113kg / 138kg

OVERALL L / W / H 2784mm / 1360mm / 1087mm

MAX MOTOR RPM 7500

MOTOR CONTROLLER Unitek Bamocar D3-700 MAX SYSTEM VOLTAGE 403,

**ELECTRODE MATERIALS** LiCoO2

COMBINED ACCUMULATOR CAPACITY 703kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Single-stage spur gear **DIFFERENTIAL** Electronic torque distribution, torque

**COOLING** Watercooled motors and motor-controllers,

mounted dual radiators **BRAKE SYSTEM** 4-Disk system, self-designed rotors, adjustable brake balance, 4 piston Fr+2 piston Rr

r-units mounted on chassis MATERIAL HM fibers, aluminium/nomex honeycomb

WHEELBASE / TRACK (Fr / Rr)

TYRES (Fr / Rr) Continental C18

MOTOR TYPE self-developed PMSM

**OVERALL L / W / H** 2930mm / 1560mm / 1200mm

WHEELS (Fr / Rr) Student design CFRP-Rim 7.5"

NUMBER OF MOTORS / LOCATION / MAX POWER

**ELECTRONICS** self-developed control system for data

FRAME CONSTRUCTION CFRP sandwich monocoque,

WEIGHT WITH 68kg DRIVER (Fr / Rr) 120kg / 120kg

SUSPENSION Double unequal length A-Arm. Pull rod damper. Heave & roll separately adjustable

#### **KARLSRUHE**

Karlsruhe Institute of Technology

Pit 10-B WRL 4

Germany

"One team - three cars!" KA-RaceIng is designing, manufacturing and

competing with a FSC, FSE and FSD car every year. The KIT18e is the first car that is developed on the basis of our lap time simulation and is characterized by our high degree of vertical integration. Self-developed electric motors, inverter, gearbox, accumulator management system... Even the beer is developed in house













TRANSMISSION RATIO (PRIMARY / SECONDARY) DRIVE TYPE planetary gear

**COOLING** 2 radiators, watercooling, separated cooling circuits for motors and inverter

BRAKE SYSTEM 4-Disk system

**FRAME CONSTRUCTION** CFRP sandwich monocoque with tubular steel roll bars

**OVERALL L / W / H** 3001mm / 1392mm / 1168mm

MATERIAL Prepreg Carbon Fiber layup with Rohacell IG sandwich panels (20-25mm core,1.1-3.7mm carbon per side)



## **ELECTRONICS** Live-Telemetry, Traction Control, Active Yaw Control, Torque Vectoring, Interface Unit

DIFFERENTIAL n/a

#### **KIEL**

**University of Applied Sciences Kiel** 

Car 53

Pit 19-A WRL 61

After two consecutive years without participation Raceyard E is back to FSG in 2018! After one stressful year we are more than excited to compete in Hockenheim for the 11th time in the teams' history. With one of the most experienced teams in the last years and the great support from our sponsors, we managed to pull off a huge technological leap. We designed and build our first Monocogue and a new four-wheel drive system in just one season, besides many other great changes to the car.











**TYRES (Fr / Rr)** 205/470 R13, Continental C17 / 205/470 R13, Continental C17

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE TI085-052-070-04B6S-07S04BA2 **MAX MOTOR RPM** 19 MOTOR CONTROLLER Lenze-Schmidhauser Mobile DCU

MAX SYSTEM VOLTAGE 600 ELECTRODE MATERIALS LiCoO2 **COMBINED ACCUMULATOR CAPACITY** 8,7 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** 1.5-stage planetary gearbox DIFFERENTIAL N/A

**COOLING** Dual cycle water cooling on motor and controller. Air cooled Accumulator BRAKE SYSTEM Topology optimized brake system designed for SLM manufacturing process

ELECTRONICS Self developed LoRaWAN Telemetry, IMU,

111



#### KÖLN

Technische Hochschule Köln

Car 11 Pit 04-B WRL 89

Germany

eMotorsports Cologne was found in 2009 at the TH Köln and compete this year with their ninth car - the eMC18 Umicore EvoLoup, the evolution of the last year car. With 35 team members we focused on reliability, efficiency, the aerodynamics, driver ergonomics and lightweight construction. The highlights are the CFRP accumulator container and the drag reduction system. We are happy to compete again at the FSG!









25



FRAME CONSTRUCTION Full CFRP monocoque (two

MATERIAL CFRP with ROHACELL core (20 mm), insert

**OVERALL L / W / H** 2873mm / 1372mm / 1190mm

WHEELBASE / TRACK (Fr / Rr) 1530mm / 1200mm / 1200mm WEIGHT WITH 68kg DRIVER (Fr / Rr) 131kg / 143kg

**SUSPENSION** Double unequal lenght A-Arm. Push Rod actuated horizontally oriented spring and damper

TYRES (Fr / Rr) Avon 7.0/16.0-10 WHEELS (Fr / Rr) 7.0 x 10

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / FR, FL, RR, RL /  $32~\mathrm{kW}$ 

MOTOR TYPE AMK/ DD5-14-10-POW-18600-B5

MAX MOTOR RPM 20000 MOTOR CONTROLLER AMK (KW26-S5-FSE-4Q)

MAX SYSTEM VOLTAGE 600

ELECTRODE MATERIALS LINIMnCoO2 **COMBINED ACCUMULATOR CAPACITY** 6.47 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Planetary gearbox

DIFFERENTIAL None

COOLING Water cooling for controllers & motors, 2 radi-

BRAKE SYSTEM 4-Disk system, adjustable brake balance, front 2 calipers, rear 1 caliper

ELECTRONICS Multifunctional steering wheel, live telemetric data transmission & GNSS positioning

#### **MANNHEIM**

Car 101 Pit 20-B

watching!:)



We proudly present you our CM-18e ,Gudrun', which is the second ever build formula student car by 70 students of DHBW Mannheim and the first one to compete in FSG. The car features ,Pedal Scaling', a realtime indication of the accelerator and brake pedal by LED-bars on the sides and rear. It leads to improved road-safety towards other road users when e.g. not only indicating that you are braking but aswell showing how hard you are braking or that you are accelerating again. Have fun













**OVERALL L / W / H** 2970mm / 1440mm / 1180mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 135kg / 200kg SUSPENSION Front and Rear Pushrods, double wishbones, rizontal side mounted air sprung

TYRES (Fr / Rr) Pirelli 180/40-13 / Pirelli 180/40-13 WHEELS (Fr / Rr) 7x13, 30mm Offset, 1 pc Mg Rim / 7x13,

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE RR, RL: EMRAX 208

MAX MOTOR RPM 7

MOTOR CONTROLLER Emsiso emDrive H300

MAX SYSTEM VOLTAGE 454V

**ELECTRODE MATERIALS** LiPo

COMBINED ACCUMULATOR CAPACITY 6,26kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** planetary gear

**DIFFERENTIAL** none

COOLING Side pod mounted radiators, thermostatic cont-

**BRAKE SYSTEM** Floating 4 Disk system, 4 piston front calipers and 2 piston rear calipers with 25mm dia.

**ELECTRONICS** Live Wifi-Telemetry data, self developed

#### **MELBOURNE**

**Monash University** 

Car 65

Pit 23-C



Based in Melbourne, Australia, Monash Motorsport consists of 100+ undergraduate students operating as one team responsible for both an IC and EV car. 2018 will mark the first time Monash competes overseas in both classes, with the goal to maximise the sum of points across the two vehicles. As Monash's first EV car, M17-E features shared components with its twin, allowing for the prioritisation of testing and tuning the new electrical systems to ensure a consistent and high performing package.









 $\begin{tabular}{ll} \textbf{FRAME CONSTRUCTION} Steel tube spaceframe, CF panel floors, AI rear bulkhead plate, steel rear frame \\ \end{tabular}$ MATERIAL 1020 and 4130 steel tubing, composite panels, OVERALL L / W / H 2985mm / 1391mm / 1185mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 145kg / 184kg **SUSPENSION** Double unequal length A-Arm. Direct acting spring and damper. Rear anti-roll bar.

TYRES (Fr / Rr) 190x53 R10, Hoosier R25B / 190x53 R10,

WHEELS (Fr / Rr) 8x10, +3 inch offset, 3 pc CF rim, Al centre / 8x10, 0 inch offset, 3 pc CF rim, Al centre

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE Emrax 228 High Voltage Combined Cooling MAX MOTOR RPM 6500

MOTOR CONTROLLER Bamocar D3-700-400-PG MAX SYSTEM VOLTAGE 498V

ELECTRODE MATERIALS Li(NiCoMn)O2 **COMBINED ACCUMULATOR CAPACITY** 9,96 TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Single reduction 428 pitch chain drive **DIFFERENTIAL** Drexler Limited Slip, Drive BR: 12:88, Decel BR: 49:51, 30-35Nm preload

**COOLING** Twin side pod mounted radiators with digitally thermal control of fans

**BRAKE SYSTEM** Outboard 4 disc system, high tensile steel rotors, adjustable brake balance

**ELECTRONICS** Self-designed ECU firmware with active SoC based derating and multi-mode traction control

#### MÜLHEIM A.D.R.

**Hochschule Ruhr West - University of Applied Sciences** 

Car 119 Pit 12-C WRL 120

competition in Hockenheim.

built the third electric car from the team. The new seasons car which is

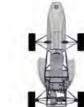
named "EM03" is designed and constructed by our young professio-

nal team members. The focus was on a low weight and a solid general

concept to take the maximum out of the car. Locking forward to a great

Germany





FRAME CONSTRUCTION Tubular Steel Frame MATERIAL S355.12H OVERALL L / W / H 2920mm / 1579mm / 1146mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 193kg / 145kg

**SUSPENSION** Double equal length A-Arm, Pushrod, one TYRES (Fr / Rr) 20.5x7.0 R13, Hoosier R25B / 20.5x7.0 R13

WHEELS (Fr / Rr) MONO 7x13 ET11 AI Rim / MONO 7x13

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE EMRAX 228 MAX MOTOR RPM 5170

MOTOR CONTROLLER Unitek Bamocar D3

MAX SYSTEM VOLTAGE 400

ELECTRODE MATERIALS LiCoO2

**COMBINED ACCUMULATOR CAPACITY** 6

TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE chain drive DIFFERENTIAL Clutch pack limited slip, 1200 Nm maxi-

COOLING Left side mounted radiator

MATERIAL carbon fibre reinforced plastic

WHEELBASE / TRACK (Fr / Rr)

**OVERALL L / W / H** 2935mm / 1434mm / 1176mm

WEIGHT WITH 68kg DRIVER (Fr / Rr) 115kg / 115kg

BRAKE SYSTEM 4-Disk system, each with 2 pistion calip-

FRAME CONSTRUCTION CFRP Monocoque with alumini-

**ELECTRONICS** Third generation self-developed AMS, cell



**Technical University of Munich** 

Car 31 Pit 16-B WRL 32

**MÜNCHEN** 

(electric + driverless). One Team - Two cars - TUfast. The main goals

designing the TUfast eb018 are lightweight design and aerodynamics

goals: Wheel hub Drive, full CFRP- monocoque, Hoosier LCO on CFRP

Rims, Planetary Gears, DRS. Feel free to come to our pit and talk to us!

well-balanced between high downforce and efficiency. To achieve these



**SUSPENSION** Double unequal length A-Arm, Front: Push rod actuated, Rear: Push rod actuated TYRES (Fr / Rr) 18x6.0-10 LC0 Hoosier / 18x6.0-10 LC0 WHEELS (Fr / Rr) 6,0 x 10, 1pc: CFRP Shells / 6,0 x 10, 1pc NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE Fischer TI085

MAX MOTOR RPM 20 MOTOR CONTROLLER TUfast MC018 (self-developed) MAX SYSTEM VOLTAGE 600

**ELECTRODE MATERIALS** LiPo COMBINED ACCUMULATOR CAPACITY 7,2kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)
1:13,7 / N/A

**DRIVE TYPE** planetary gearing system

DIFFERENTIAL N/A

**COOLING** Rear mounted radiators with ducting **BRAKE SYSTEM** self-built aluminium calipers, drilled floating rotors, adjustable brake balance

**ELECTRONICS** Multifunctional Steering Wheel and Dashboard, Drag Reduction System

## **MÜNCHEN**

University of Applied Sciences München



Pit 09-C WRL 11

PassionWorks - not only the name of our cars but also our guiding principle! Focussing on the utilization of last season's lessons learned we built an aerodynamically and mechanically advanced car to further

Germany





FRAME CONSTRUCTION Full Composite Monocoque

MATERIAL CFRP, Aramid, PMI Foam, Epoxy Resin

**OVERALL L / W / H** 2875mm / 1410mm / 1190mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 128kg / 129kg **SUSPENSION** Double unequal length A-Arms, Pull-rod actuated horizontally mounted three spring system

TYRES (Fr / Rr) 205/470R13 Continental C18 / 205/470R13

WHEELS (Fr / Rr) 7x13 CFRP rim with aluminium star /

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / Upright mounted / 32kW, 32kW, 32kW, 32kW MOTOR TYPE AMK / DT5-14-10-POW

MAX MOTOR RPM 20000 MOTOR CONTROLLER AMK / KS26-S5-FSE-4Q MAX SYSTEM VOLTAGE 600V

ELECTRODE MATERIALS LINICOAIO2 **COMBINED ACCUMULATOR CAPACITY** 7,620kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

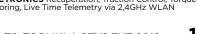
**DRIVE TYPE** planetery gearbox with step planets



**COOLING** Rear mounted radiators with thermostatically controlled electric fans, water cooled motor housings **BRAKE SYSTEM** 4 calipers, floating, x20cr13, hub mounted, effective diameter 230.5/236mm (front/rear) **ELECTRONICS** Recuperation, Traction Control, Torque Vectoring, Live Time Telemetry via 2,4GHz WLAN







#### NÜRNBERG

Georg-Simon-Ohm-Hochschule Nürnberg

Car 60 Pit 16-C WRL 65

Germany



Strohm+Söhne is the FSE team of Nuernberg(DEU) and was founded in '11. Our 5th racecare NoRa5 was designed to be a complete change in comparision to the premodel. An aluminium monocoque was constructed to safe weight. The switch of rear-wheel drive to 4 wheel drive allows us to transfer the torque more efficient into acceleration and gives us the possibility to support the driver with torque vectoring. We are also proud of our self-developed electrical devices like the AMS and Smart Sensors















FRAME CONSTRUCTION Aluminium sandwich monoco-

MATERIAL Plascore honeycomb - AW6082 skins (18 mm core, sides 0.8 and 1 mm)

**OVERALL L / W / H** 2705mm / 1420mm / 1112mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 131kg / 155kg **SUSPENSION** Double A-Arm. Push rod actuated, KW dampers. Adjustable damping, ride & roll rate

TYRES (Fr / Rr) 205x470 R13 34M Continental / 205x470 R13 34M Continental

WHEELS (Fr / Rr) 7Jx13 FH2 ET22 OZ Racing Al Rim/
7Jx13 FH2 ET22 OZ Racing Al Rim

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE FL, FR, RL, RR: AMK-DD5-14-10-POW-

MAX MOTOR RPM FL, FR: 20.000 RR, RL: 20.000

MOTOR CONTROLLER AMK - KW26-S5-FSE-4Q 2 MAX SYSTEM VOLTAGE 600V **ELECTRODE MATERIALS** LiCoO2 - Lithium polymer

COMBINED ACCUMULATOR CAPACITY 6 4kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Planetary Gearbox

DIFFERENTIAL N / A

COOLING two 800cc radiators mounted on each side of car, no fan used, carbon cooling duct

**BRAKE SYSTEM** 4-Disk system, self developed rotors with 202mm/176mm diameter (front/rear)

FRAME CONSTRUCTION Aluminum Sandwich panel mo-

MATERIAL Aluminum skin with aluminum honeycore comb

ore-0.8mm skin on sides and 15mm core -1mm ski

**ELECTRONICS** Self developed CAN sensor node system

coque, bonded and riveted aluminum lap-joint

**OVERALL L / W / H** 2869mm / 1460mm / 1172mm

WHEELBASE / TRACK (Fr / Rr)

#### **PATRAS**

**University of Patras** 

Car 86 Pit 12-A WRL 50



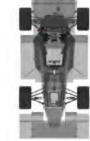
UoP Racing is the University of Patras FS team. After 5 combustion and 3 e-cars, we are presenting UoP6e. The overall focus is "resource efficiency", adopting cost-effective solutions. Simplicity, reliability and high performance were also top priorities. UoP6e utilizes an aluminum panel cut-n-fold monocoque chassis and a single e-motor, accompanied by self-developed electronics (VCU, AMS, Telemetry system, CAN nodes) and an advanced aerodynamic package. Eager to learn more? Come visit us!

















MOTOR TYPE Brushless Permanent Magnet Synchronus

MAX MOTOR RPM 4800

MOTOR CONTROLLER Unitek Bamocar-D3 MAX SYSTEM VOLTAGE 504V **ELECTRODE MATERIALS** LiCoO2

FRAME CONSTRUCTION

OVERALL L / W / H mm / mm / mm

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

NUMBER OF MOTORS / LOCATION / MAX POWER

TRANSMISSION RATIO (PRIMARY / SECONDARY)

WHEELBASE / TRACK (Fr / Rr)

MATERIAL

SUSPENSION

MOTOR TYPE

DRIVE TYPE

COOLING

DIFFERENTIAL

BRAKE SYSTEM

**ELECTRONICS** 

TYRES (Fr / Rr)

WHEELS (Fr / Rr)

MAX MOTOR RPM

MOTOR CONTROLLER

MAX SYSTEM VOLTAGE

**ELECTRODE MATERIALS** 

COMBINED ACCUMULATOR CAPACITY

**COMBINED ACCUMULATOR CAPACITY 7.1kWh** TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Single-Speed, Parallel Shaft Gearbox **DIFFERENTIAL** Drexler FSAE Limited Slip Differential **COOLING** Single radiator, fanless, 3D printed air duct for air supply, water cooled, electric water pump BRAKE SYSTEM Fr./ ISR 22-048 OB four piston, radial mount- Re./ISR 22-049 two piston, radial mount **ELECTRONICS** Self designed live telemetry system, Custom VCU-Logging Unit-CAN nodes, CANbus channels

#### **QUEBEC CITY**

Université Laval

Car 42

Pit 22-C WRL 22



FormUL 2018 follows the design philosophy passed from generation to generation here at Laval University, which is to push forward the innovation and go beyond the limits of our car by self-designing every major component, such as electric motors, drive and accumulator. The 2018 race car is a 4WD, fully electric racing machine, powered by four water-cooled in-hub motors mated on 2 stage custom planetary speed reducers. Also featuring a complete aero package mounted on a light weight spaceframe.









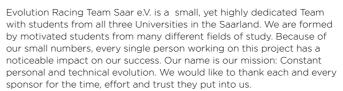


#### **SAARBRÜCKEN**

Saarland University

Car 30 Pit 23-B WRL 77

Germany

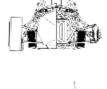














WEIGHT WITH 68kg DRIVER (Fr / Rr) 116kg / 175kg  ${\color{red} \textbf{SUSPENSION}} \ \text{double unequal length a-arm, FS dampers}$ 

TYRES (Fr / Rr) Hoosier R25B/WET R13 **WHEELS (Fr / Rr)** 7.0x13 Mg Rims by O.Z. 1pc.

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE PSM Vues AFW507

MAX MOTOR RPM 7500

MOTOR CONTROLLER Bamocar D3 400/700 by Unitek MAX SYSTEM VOLTAGE 504

ELECTRODE MATERIALS LiPo (LiCoO2)

**COMBINED ACCUMULATOR CAPACITY** 5,594

TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** rear-wheel-drive

**DIFFERENTIAL** electric differential with torque vectoring **COOLING** twin-side mounted radiators, 120mm electric fan, optimised radiator size

BRAKE SYSTEM fixed brake calipers by AP-Racing, pullod-actuated brake cylinders

**ELECTRONICS** self-designed PCBs and Software for each purpose (MCU,BSPD,TSAL...)

MATERIAL CFK Prepreg with aluminium honeycomb core

WEIGHT WITH 68kg DRIVER (Fr / Rr) 141kg / 152kg

SUSPENSION Double whishbone pushrod actuated hea-

NUMBER OF MOTORS / LOCATION / MAX POWER

FRAME CONSTRUCTION Composite monocoque

**OVERALL L / W / H** 2908mm / 1416mm / 1156mm

TYRES (Fr / Rr) 18.0x6.0-R10, Hoosier R25B

WHEELS (Fr / Rr) 10x6.5 aluminium machined

WHEELBASE / TRACK (Fr / Rr)

#### SANKT AUGUSTIN

University of Applied Sciences Bonn-Rhein-Sieg

Car 45 Pit 16-A WRL 28

Germany



BRS Motorsport is the Formula Student team of UAS Bonn-Rhine-Sieg with about 70 students of all faculties, who share their love for designing, developing and manufacturing their second all-wheel driven electric car. It sticks out with its CFRP monocoque with 10" aluminium wheels, heave-spring system, a powertrain package by AMK combined with a compound planetary gearbox in the uprights and an aerodynamic package.











**ELECTRODE MATERIALS** LiNiCoAl COMBINED ACCUMULATOR CAPACITY 7.78kWh TRANSMISSION RATIO (PRIMARY / SECONDARY) **DRIVE TYPE** 4 gearboxes in the uprights

**DIFFERENTIAL** electrical differential (software) **COOLING** three self developped mounded radiators BRAKE SYSTEM four self developped disks with 4 piston ers in the front and 2 in the real

**ELECTRONICS** 3D wiring harness, self developped ECU's, multifuntional steering wheel and dashboard

FRAME CONSTRUCTION steel tube frame

OVERALL L / W / H 2960mm / 1420mm / 1175mm

**TYRES (Fr / Rr)** Hoosier 18.0×7.5-10 R25B/Hoosier

WEIGHT WITH 68kg DRIVER (Fr / Rr) 147kg / 166kg

**SUSPENSION** Double unequal length A-Arm.Front:Pull rod actuated,Rear:Push rod actuated

#### **SHIYAN**

**Hubei University of Automotive Technology** 

Car 29

Pit 19-C



DONGFENG HUAT FLECTRIC RACING TEAM was established in 2014.In the past years, we have developed professional technology to improve the skills of both design and manufacturing, and also committing ourselves to build a world-class team. With the support of our university and DONGFENG TRUCKS, and also owing to the help from previous technical knowledge and experience of our petrol racing team, DONGFENG HUA-TE RACING TEAM won the national championship in the 2017 FORMULA STUDENT ELECTRIC CHINA.











WHEELBASE / TRACK (Fr / Rr)

MATERIAL 4130 steel



**ELECTRODE MATERIALS** Lithium cobaltate--graphite COMBINED ACCUMULATOR CAPACITY 7.03Kwh TRANSMISSION RATIO (PRIMARY / SECONDARY) DRIVE TYPE One stage chain transmission

**DIFFERENTIAL** Drexler limit slip differential COOLING Rear two 270cc mini radiators and 120mm two BRAKE SYSTEM 4-Disk system, adjustable brake balance

**ELECTRONICS** Selfdesigned Live-Telemetry System.



#### **STUTTGART**

**Baden-Württemberg Cooperative State University Stuttgart** 

Car 5 Pit 07-B WRL 7

Germany



DHBW Engineering Stuttgart - a team of nearly 100 students of the Cooperative State University of Baden Wuerttemberg. Founded in 2008 we have been participating in the Formula Student Combustion until we decided to switch to Formula Student Electric in 2011. Because of our special form of study and all other challenges that arise from Formula is why we depend on a perfectly harmonizing team to build our A-Team-









FRAME CONSTRUCTION unibody monocoque with integ-

MATERIAL hM/ HT Carbon fibers/ Aluminium honeycomb **OVERALL L / W / H** 2934mm / 1442mm / 1193mm WHEELBASE / TRACK (Fr / Rr) 1580mm / 1220mm / 1220mm

WEIGHT WITH 68kg DRIVER (Fr / Rr) 120kg / 136kg **SUSPENSION** double A-Arms, Push rod actuated spring-damper-system with decoupled drive modes

TYRES (Fr / Rr) 18.0x7.5 R10, Hoosier R25B /18.0x7.5 R10,

WHEELS (Fr / Rr) 7x10,38mm offs,2-pcs. Al star,CFK bed / 7x10,38mm offs,2-pcs. Al star,CFK bed

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR TYPE AMK DT5

MAX MOTOR RPM 20000 ( Front and Rear) MOTOR CONTROLLER AMK KW26 MAX SYSTEM VOLTAGE 588V **ELECTRODE MATERIALS** LiCoO2 COMBINED ACCUMULATOR CAPACITY 6 78 kWh

TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE

**DIFFERENTIAL** non

**COOLING** single circuit for power electronic and motors; radiators placed on the side

**BRAKE SYSTEM** uter: 184.4mm, Inner:123.6mm, Floating, hubmounted, steel; 15.9 mm piston diameter

**ELECTRONICS** Multifunctional Steering Wheel, Telemetry

#### **STUTTGART**

**University of Stuttgart** 

Car 26 Pit 04-A WRL 2

For nine years, the GreenTeam participates at Hockenheim. With the

new E0711-9 we continue our successful story. With our 9th generation

car we combined the benefits of its predecessor with new convincing

innovations. The overall focus was set on performance and reliability for

the E0711-9. Highlights this year are the aerodynamic package, vehicle

dynamics, improved oil cooled accumulator and lightweight design.



FRAME CONSTRUCTION Carbon fiber sandwich structure

MATERIAL Aluminum honeycomb sandwich panel **OVERALL L / W / H** 3000mm / 1440mm / 1200mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 119kg / 124kg SUSPENSION Double A-Arm, heave/roll spring-dam-

TYRES (Fr / Rr) 18 x 7.5 - 10, Hoosier R25B / 18 x 7.5 - 10,

WHEELS (Fr / Rr) 8.0 wide 2 pc Hybrid (Al, CFRP) / 8.0 wide 2 pc Hybrid (Al, CFRP)

NUMBER OF MOTORS / LOCATION / MAX POWER

4 / Wheel hub mounted / 34.5 per Motor

MOTOR TYPE permanently excited synchronous machine MAX MOTOR RPM 20000

MOTOR CONTROLLER KW26-S5-FSE-4Q

MAX SYSTEM VOLTAGE 592

**ELECTRODE MATERIALS** LiCoO2

**COMBINED ACCUMULATOR CAPACITY** 6,8 TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** planetary gearbox DIFFERENTIAL -

**COOLING** Oil and water circuit

**BRAKE SYSTEM** 4-Disk system, self developed coated aluminum brake disks

**ELECTRONICS** self-designed system electronics, wireless CAN and live video feed

#### **TALLINN**

**Tallinn TU - University of Applied Sciences** 

116

Car 124 Pit 10-C WRL 12

Estonia



Formula Student Team Tallinn is based in Estonia and is the only team in our country. Although being from a small country we are currently the highest ranking electric team in Eastern Europe and Scandinavia. The team first came together in 2006 and since then has competed in all the major competitions in Europe and United States. Over the years our team has enjoyed a steady growth and development, keeping up with the latest technologies and celebrating many successes along the way.

















FRAME CONSTRUCTION CFRP single piece monocoque MATERIAL Rohacell foam (5-20mm core) **OVERALL L / W / H** 2896mm / 1460mm / 1163mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITH 68kg DRIVER (Fr / Rr) 120kg / 128kg **SUSPENSION** Double wishbone suspension. Push rod actuated horizontally oriented spring and damper.

TYRES (Fr / Rr) 18x7.5-10, Hoosier R25B / 18x7.5-10, WHEELS (Fr / Rr) 10X8 carbon/10X8 carbon

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / FR,FL,RR,RL / 35kW, 35kW, 35kW, 35kW

MOTOR TYPE FL, FR, RR, RL: AMK DD5-14 MAX MOTOR RPM FL, FR, RR, RL: 20.000 MOTOR CONTROLLER AMK KW26-S5-FSE-4Q

MAX SYSTEM VOLTAGE 550 **ELECTRODE MATERIALS** Lithium-Polymer COMBINED ACCUMULATOR CAPACITY 6.5 kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** Two stage planetary gearbox DIFFERENTIAL 4 wheel drive torque vectoring. Longitudi-

**COOLING** Self designed 3D printed radiators and cooling plates for motors and controllers

BRAKE SYSTEM 4 disc brakes, regenerative braking **ELECTRONICS** Self developed systems include: 4G telemerty, AMS, ECU, Ground Speed Sensor, dashboard

#### TRONDHEIM

freedom. See you at FSG!

Norwegian University of Science and Technology

Car 63 Pit 09-A WRL 33

all years of study, competing in both the EV and DV class for the first

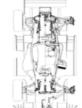
time this year. For ATMOS, our EV car, we have focused on reliable elec-

tronics, increased downforce and improved data analysis. We have also

added a heave spring, to gain more control of one additional grade of

Norway





MATERIAL IM 2x2 twill prepreg and HM UD prepreg with Foam & ALUHC core sandwich panel **OVERALL L / W / H** 2870mm / 1400mm / 1185mm

FRAME CONSTRUCTION CFRP two-piece monocoque

WHEELBASE / TRACK (Fr / Rr) 1530mm / 1200mm / 1180mm WEIGHT WITH 68kg DRIVER (Fr / Rr) 120kg / 127kg

**SUSPENSION** SLA, upper wishbone push rod actuated, T-bar ARB w/ 3rd spring TYRES (Fr / Rr) 205x34 R13 - Continental C17, front and

WHEELS (Fr / Rr) 7x13, 36mm offset, two pc CFRP/Al Rim,

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / Hub mounted / 37 kW **MOTOR TYPE** AMK DD5-14-10-POW-18600-B5

MAX MOTOR RPM 20 000

MOTOR CONTROLLER AMK KW26-S5-FSE-4Q

MAX SYSTEM VOLTAGE 588

ELECTRODE MATERIALS LiCoO2

COMBINED ACCUMULATOR CAPACITY 6.8 kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

DRIVE TYPE Hub mounted compound planetary gearbox DIFFERENTIAL N/A

COOLING Dual cycle, mounted inside sidepod w/ fans and BRAKE SYSTEM 4-Disk system, self developed rotors, self

**ELECTRONICS** All PCB's except IMD, telemetry and the

FRAME CONSTRUCTION Single Piece CFRP Monocoque

MATERIAL Single Piece CFRP Monocoque with EN AW

WEIGHT WITH 68kg DRIVER (Fr / Rr) 132kg / 127kg

SUSPENSION double unequal A-arm, pushrod actuated

TYRES (Fr / Rr) 152x20 R10, Hoosier / 152x20 R10, Hoosier

WHEELS (Fr / Rr) 6.0x10, 3 piece AL-Carbon rim / 6.0x10, 3 piece AL-Carbon rim

NUMBER OF MOTORS / LOCATION / MAX POWER

MOTOR CONTROLLER AMK KW26-S5-FSE-4Q

**OVERALL L / W / H** 2898mm / 1408mm / 1039mm

WHEELBASE / TRACK (Fr / Rr)

MOTOR TYPE AMK DT5-14-10-POW

MAX MOTOR RPM 20000 [1/min]

2000

#### WOLFENBÜTTEL

University of Applied Sciences Ostfalia

Car 35 Pit 17-C WRL 47

Switzerland

Team wob-racing is the second largest automobile manufacturer from Wolfsburg - and in our 15th year, we present you WR14, completely new design with first carbon-monocogue and first electric all-wheel-drive. With our 50 team members we created a whole new technical basis which offers 136 kW on 190 kg. And thanks to the new torque vectoring and new kinematics, WR14 does lay some impressive lap times.



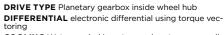












**COOLING** Water-cooled inverters and motors, one radiator on each side, air-cooled battery pack

**BRAKE SYSTEM** 4x floating 190 mm rotors, separate systems for front and rear, adjustable balance

**ELECTRONICS** Multifunctional driver interface, 3 CAN bus architecture, self designed data acquisition s

#### **ZÜRICH**

Swiss Federal Institute of Technology Zurich

Car 33

Pit 20-A WRL 1

The AMZ Racing team was founded in 2006 by students of ETH Zurich. After three combustion cars, the AMZ switched to electric racing cars in 2010 and started an ongoing collaboration with the University of Lucerne. The active team counts approximately 35 people, backed by the crucial support of their alumni. In 2017, AMZ finished the season at the top of FSE rankings, but also grew up to the challenge as "official" raclette (swiss molten cheese) provider of FSG, FSA and FSS.







FRAME CONSTRUCTION CFRP one-piece monocoque MATERIAL intermediate modulus CFRP prepreg (twill & UD) with aluminium honeycomb core OVERALL L / W / H 2929mm / 1463mm / 1188mm

WHEELBASE / TRACK (Fr / Rr)
1530mm / 1220mm / 1220mm WEIGHT WITH 68kg DRIVER (Fr / Rr) 115kg / 125kg

SUSPENSION double A-arm, hydraulically actuated pullrod,

TYRES (Fr / Rr) 205/470 R13; custom C18 Continental tyre (Fr & Rr) WHEELS (Fr / Rr) 7", CFRP rim, 53 mm wheel offset (Fr &

NUMBER OF MOTORS / LOCATION / MAX POWER 4 / FL, FR, RL, RR / 4x 41.9 kW

MOTOR TYPE AMZ M8, self developed, PMSM inrunner MAX MOTOR RPM 24'000 RPM

MOTOR CONTROLLER AMZ II, self developed inverters MAX SYSTEM VOLTAGE 470V **ELECTRODE MATERIALS** LiPo

**COMBINED ACCUMULATOR CAPACITY** 5.5 kWh TRANSMISSION RATIO (PRIMARY / SECONDARY)

**DRIVE TYPE** planetary gear with staged planets DIFFERENTIAL N/A

**COOLING** single serial cooling circuit with two radiators actively cooled by two fans, mounted on the back BRAKE SYSTEM self developed, one piece, 3D printed

callipers, 227 mm floating rotors **ELECTRONICS** in-house optical AMS, live telemetry system, CAN communication, self developed CAN modules

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#### **BERLIN**

Hochschule für Technik und Wirtschaft Berlin

Car 538 Pit 32

Germany



We are happy to present you the BRC18 with its newly developed adaptive autonomous system, aerodynamics, aggressive powertrain packaging and hydraulic system. Besides FSG and FSEast DV, we are competing in FSN CV with the same car. We are totally committed to set new team records, but even more to celebrate the formula student atmosphere. Visit us at our pit and see more! #NoDriverNoDrama #Umweltplakette #NichtUnter13.8km/h #PlugAndPray #CVDVoneCar







#### **DRIVERLESS COMBUSTION**

FRAME CONSTRUCTION Hybrid Monocoque: Front CFRP Monocoque / Rear Steel Tube Frame

MATERIAL CFRP Monocoque (HT Fibre & Rohacellcore) & Frame 25 4mm diam 25CrMo4

OVERALL L / W / H 2936mm / 1421mm / 1190mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 78kg / 117kg **ENGINE** KTM SX-F 505 2008

BORE / STROKE / CYLINDERS / DISPLACEMENT

BRAKE SYSTEM 4 Disk System PROCESSING UNITS Nvidia Jetson TX2

PERFORMANCE OF PUs 1500 GFLOPS

POWER CONSUMPTION OF PUs 15 W CAMERAS Matrix Vision mvBlueFOX3-2

RADAR n/a

LIDAR Velodyne VLP16

OTHER SENSORS Corrsys Datron SL (2 axis), Vectornav IMU VN300 with dual gps

HIGHLIGHTS OF THE DV SYSTEM complete new vehicle design with integrated DV sensors, adaptive design (30 min to install/remove all DV components) for CV and DV use, one hydraulic system for steering, clutch and brake



#### **KEMPTEN**

**University of Applied Sciences Kempten** 

Car 585 Pit 34-A

Germany



We are Infinity Racing, the Formula Student team of the University of Applied Sciences Kempten in Bavaria, Germany. The driverless team was founded in 2016. For this saison we start with fifteen passionate student and the TOMSOI VIII as base vehicle. Our main focus was to converting the combustion vehicle into an autonomous vehicle. Our core unit is a powerful embedded board TDA2X by Texas Instruments which handle with Simple and robust algorithm for mono camera and environmental model.









#### DRIVERLESS COMBUSTION

FRAME CONSTRUCTION Hybrid Monocoque; Front: Com-

MATERIAL carbon-fibre composite; E235+C1 steel round

OVERALL L / W / H 3008mm / 1390mm / 1160mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 124kg / 126kg ENGINE 2005 Yamaha R6 RJ 09 4 cylinder DOHC

BORE / STROKE / CYLINDERS / DISPLACEMENT

65,5mm / 44,5mm / 4 cylinders / 599cc

BRAKE SYSTEM 4-Disk system, 200 mm dia. Vented, adjustable brake balance

PROCESSING UNITS Texas Instruments TDA2x, Atmel

PERFORMANCE OF PUs 6,33 GFLOPS

POWER CONSUMPTION OF PUs  $20\ W$ 

**CAMERAS** GigE, uEye, FA, 1/2" OnSemi Python 1300 CMOS Farb Sensor, 1280x1024 Pixel, Global Shutter, Trigger-E

RADAR n/a

LIDAR n/a

**OTHER SENSORS** Peak System PCAN-GPS, programmable sensor module, satellite receiver, magnetic field sensor, accelerometer, gyroscope, CAN

HIGHLIGHTS OF THE DV SYSTEM Our main focus was to converting the combustion vehicle into an autonomous vehicle. Powerful steering systems and brake system (MK100 by Continental). Embedded systems: TDAZx of Texas Instruments and Atmel 90CAN128 as Interface between Sensors and Actuators: Software development: simple and robust algorithm for the monocamera with decision tree

#### WEINGARTEN

University of Applied Sciences Ravensburg-Weingarten

Car 560 Pit 32-C

Germany



The new Driverless Team from Weingarten takes on a fresh challenge and fields their first driverless racecar this season - with four cylinders! For their the tenth season in Formula Student, the team from Weingarten decided to take the 2017 model, the Stinger17 and equip it with the necessary hardware to make it drive autonomously. We would like to express our sincere thanks to our sponsors and everyone supporting the project!











#### DRIVERLESS COMBUSTION

FRAME CONSTRUCTION Tubular steel space frame MATERIAL CFRP prepreg sandwich panels **OVERALL L / W / H** 3148mm / 1431mm / 1194mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 86kg / 99kg ENGINE Modified Honda CBR 600 RR (PC 40)

BORE / STROKE / CYLINDERS / DISPLACEMENT 67mm / 42,5mm / 4 cylinders / 599cc **BRAKE SYSTEM** Rear mono brake, selfdesigned rotors &

PROCESSING UNITS Nvidia Drive PX 2 Autochauffeur

PERFORMANCE OF PUs GFLOPS POWER CONSUMPTION OF PUS W

CAMERAS Intel RealSense D435 x 1 RADAR

LIDAR Velodyne VLP-16 x 1

OTHER SENSORS

HIGHLIGHTS OF THE DV SYSTEM - Automatic Clutch hifting, - Neural network for cone detection, - Sensor ion between camera & lidar, - ROS



#### **AACHEN**

**RWTH Aachen University** 

Car 499 Pit 32-A

Ecurie Aix is one of the oldest Formula Student Teams in Germany, foun-

ded in the year 2000. The team name is derived from the french words

ecurie meaning racing team and aix standing for Aachen. Our team has

65 members responsible for building two cars: redesigning one car for

chose a new car as basis for our driverless competitor. Additionally to

our system from last year, we use two Lidar to detect the environment.

the driverless competition and an electric race car. For the year 2018 we

Germany





#### **DRIVERLESS ELECTRIC**

FRAME CONSTRUCTION CFRP Monocoque in sandwich

MATERIAL HTA40 Prepreg, M40J UD Prepreg, Rohacell 51WF foam core, 72kg/m<sup>3</sup> 5052 Aluminium

**OVERALL L / W / H** 2932mm / 1526mm / 1126mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 79kg / 146kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / all wheel hubs / 33 kW

**COMBINED ACCUMULATOR CAPACITY** 7,46 kWh

**BRAKE SYSTEM** 4-Disk system, self-developed rotors with 240mm diameter, adjustable brake balance

PROCESSING UNITS Nvidia Jetson TX2

PERFORMANCE OF PUs 2072 GFLOPS

POWER CONSUMPTION OF PUs 60 W W

CAMERAS 2x ZED stereocamera, angle: 110 degrees ,range: RADAR none

LIDAR 2x SICK LD-MRS420201, anlge: 110 degrees, range:

OTHER SENSORS Sensonor STIM300 IMU

HIGHLIGHTS OF THE DV SYSTEM Redundant object detection via stereo cameras and LIDAR sensors. Multiple processing units. Full onboard localization with optional GPS.

#### **AUGSBURG**

**University of Applied Sciences Augsburg** 





Hungary

The StarkStrom Driverless Team was part of the Formula Student Driverless competition from the first day on. In 2014 our team already used automated testing to improve a torque vectoring controller. Therefore, we were the first ever Formula Student Team which developed an autonomous race car. With all our knowledge on automated driving we have improved our new autonomous system, which can sense the environment, calculate a trajectory in real time and dynamically estimate







FRAME CONSTRUCTION One piece Composite monoco-

MATERIAL Carbon Fiber with honeycomb/ S355 steeltubing roolbars 25mm diam. / EN-AW-6061

**OVERALL L / W / H** 2888mm / 1425mm / 1030mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 115kg / 120kg NUMBER OF MOTORS / LOCATION / MAX POWER

**COMBINED ACCUMULATOR CAPACITY** 6.7 kWh BRAKE SYSTEM 4-Disk system, self developed rotors,

PROCESSING UNITS microAutoBox II (IBM PPC 750GL), Embedded PC (Intel i7-3517UE), 2x MicroZed Zyng 7020

PERFORMANCE OF PUs 42 GFLOPS POWER CONSUMPTION OF PUs 29,4 W

CAMERAS 2x Basler LVDS Camera RADAR Continental ARS 4xx, Bosch MRRe14HBW

LIDAR Velodyne VLP 16 OTHER SENSORS Forsberg ReACT GNSS, 2x U-bloxx m8p

HIGHLIGHTS OF THE DV SYSTEM High efficient camera system, based on FPGA hardware acceleration. Realtime trajectory planning at 100Hz. Highly dynamic speed calculation based on the trajectory. No blackbox algorithms!

#### **BUDAPEST**

**Budapest University of Technology and Economics** 

event on FSG.

Car 414 Pit 29-B

The BMF Formula Racing Team was founded in 2007 as the first Formula Student team of Hungary by students of TU Budapest. Since 2011 we are building electric cars, but this year, besides building a new electric car, we have also taught our last year's little girl, Honey Rider to navigate between cones on her own. So this year we are competing in driverless category, with a single goal: successfully finish every dynamic







#### DRIVERLESS ELECTRIC

FRAME CONSTRUCTION Single piece CFRP monocoque MATERIAL Sandwich structure: prepreg layers with Al honeycomb(20 [mm] thick)

OVERALL L / W / H 2714mm / 1406mm / 1003mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 117kg / 117kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / In-hub motors at 4 wheels / 35kW,35kW,35kW,35kV,35kV

COMBINED ACCUMULATOR CAPACITY 7.076kWh **BRAKE SYSTEM** 4-Disk system, 191 mm diameter rotors, adjustable brake balance

PROCESSING UNITS Nvidia Jetson TX2, TMS570LS1227

PERFORMANCE OF PUs 1500 GFLOPS POWER CONSUMPTION OF PUs 8 W

**CAMERAS** Basler acA2040-120uc mono camera, Stereolabs ZED stereo camera Stereolabs ZED camera, RADAR n/a

LIDAR Velodyne VLP16

OTHER SENSORS Vectornav VN-300

HIGHLIGHTS OF THE DV SYSTEM We are using a LiDAR sensor, a high framerate wide angle camera, and a stereo camera for perception. The algorithms are running on a Nvidia Jetson TX2 board, which runs our own cone detection and planning algorithm





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#### DARMSTADT

Technische Universität Darmstadt

Car 442 Pit 28-C

Germany



DART Racing is the Formula Student Team of the Technical University of Darmstadt. The team was founded in 2005 as an IC Team. Since 2011 we build electric race cars and since 2017 two cars each year: one electric and one electric-driverless. The lambda-D2018 is the second fully autonomous race car of our team based on the lambda2016. The main changes to the last year's driverless car are a new lidar-sensor and a new, hydropneumatic braking-actuator.









#### DRIVERLESS ELECTRIC

FRAME CONSTRUCTION Monocoque

MATERIAL CFRP-Prepreg, SGL SIGRAPREG C T24, Alumi-

OVERALL L / W / H 2966mm / 1345mm / 1182mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 106kg / 146kg NUMBER OF MOTORS / LOCATION / MAX POWER 2 / Rear Right, Rear Left / 51kW

COMBINED ACCUMULATOR CAPACITY 6.35kWh

BRAKE SYSTEM self developed rotors 240mm dia. front / 200mm dia. rear, adj. brake balance

PROCESSING UNITS Nvidia Drive PX 2, dSPACE MicroAu-

PERFORMANCE OF PUs 9600 GFLOPS

POWER CONSUMPTION OF PUs  $416\ W$ CAMERAS Autonomos Smart Stereo Camera, 110° opening

RADAR -

LIDAR Velodyne VLP-16 Hi-Res

OTHER SENSORS VectorNav VN-300, Kistler Correvit SFII HIGHLIGHTS OF THE DV SYSTEM Neuronal network for computer vision (trained with 3000 pictures), self developed mapping algorithm, sensor fusion of LIDAR and camera, localization by differential GPS, control system with 2 degrees of freedom, pneumatic brake actuation





"Horst" was built in 2017 and took part in several competitions this year.

durance in FSE17. After this eventful year Horst decided that it was time

to take the next step. So he returned to our workshop for a few months

to complete his transformation. With new skills and the newest drivers, he wants to face the challenges of the race track alone. But Horst, we

will always sit on the grandstand and send our support and love.

It is our first all-wheel drive vehicle and was able to complete the En-







#### DRIVERLESS ELECTRIC

**FRAME CONSTRUCTION** Monocoque structure with prepreg and aluminium honeycomb material

MATERIAL IMS65 UD Fibres

**OVERALL L / W / H** 2920mm / 1385mm / 1140mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 114kg / 116kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / In the Wheelhubs / 30 kW each

**COMBINED ACCUMULATOR CAPACITY** 6.7 kWh

BRAKE SYSTEM 4-Disk system, self-developed rotors,

PROCESSING UNITS LPC 4337, Intel Core i7-6700K,

PERFORMANCE OF PUs 6573 GFLOPS

POWER CONSUMPTION OF PUs 300 W

**CAMERAS** 2 x Basler - daA1600-60ucArea Scan Camera with Global Shutter, USB 3.0, Res: 1600 x 1200 pixels RADAR n/a

LIDAR 3x Ibeo Lux 2010. 4 Layer rotating mirror LIDAR

OTHER SENSORS 1x Xsens - MTi-G-710-GNSS/INS (IMU), self-developed angle sensor at steering rack

HIGHLIGHTS OF THE DV SYSTEM In processing our LiDAR data we use Bundle Adjustment to retrieve both the car movement and a cone map, effectivly using it for SLAM. The pneumatic EBS system, which is supplied by a com-pressor, can directly pressurize the hydraulic brake system. We have also a smooth integration of the dv components in the ev car. It is nearly invisible.

#### **DRESDEN**

Technische Universität Dresden

Car 411 Pit 25-B

mapping and b) on the vehicles electric system.

Germany



This is the first season for Flbflorace Driverless. Because of that, we wanted to keep everything simple in order to have a solid basis for coming years. Our main focus is therefore on reliability and sustainability regarding a) the vehicles autonomous system, e.g. path planning and











#### DRIVERLESS ELECTRIC

FRAME CONSTRUCTION full size CFRP Monocoque **MATERIAL** Pre-impregnated CFRP with Aluminium honeycomb as core material

**OVERALL L / W / H** 2955mm / 1407mm / 1146mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 110kg / 110kg NUMBER OF MOTORS / LOCATION / MAX POWER

COMBINED ACCUMULATOR CAPACITY 7

**BRAKE SYSTEM** 4-Disk system, self developed rotors and self developed front brake caliper PROCESSING UNITS Teensy 3.2, MicroAutoBox with

PERFORMANCE OF PUs 345,6 GFLOPS

POWER CONSUMPTION OF PUs 48 W **CAMERAS** 

LIDAR Velodyne Puck HiRes OTHER SENSORS

HIGHLIGHTS OF THE DV SYSTEM Optimized version of Euclidean Clustering, 3d-Cone Detection using Machine. Learning, recursive path planning using Delaunay Triangulation



#### DRIVERLESS ELECTRIC

**FRAME CONSTRUCTION** CFRP single piece monocoque with Al honeycomb core and integrated front hoop

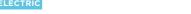
OVERALL L / W / H 2891mm / 1465mm / 1183mm

WEIGHT WITHOUT DRIVER (Fr / Rr) 78kg / 138kg

COMBINED ACCUMULATOR CAPACITY 7,66kWh

PROCESSING UNITS AMD Ryzen 7 1700, Beaglebone

LIDAR Velodyne Puck VLP-16, mounted on the front wing OTHER SENSORS SBG Ellipse-2N Inertial Navigation



WHEELBASE / TRACK (Fr / Rr)

NUMBER OF MOTORS / LOCATION / MAX POWER 2 / Rear Right, Rear Left / 40kW, 40kW

**BRAKE SYSTEM** Toolex 33 steel, Floating 195x4(fr) 186x4(rr) rotors, 4(fr) & 2(rr) piston calipers

PERFORMANCE OF PUs 42 GFLOPS POWER CONSUMPTION OF PUs 255 W

CAMERAS Stereolabs ZED camera RADAR n/a

HIGHLIGHTS OF THE DV SYSTEM Perception combines

LIDAR and Camera using cone positions provided by the LIDAR to define Regions of Interest for a CNN. Steering is controlled by a velocity dependent aimpoint considering the number of cones seen and velocity is dependent on road curvature. The unique OpenDLV framework is used to realize the software as a suite of microservices.

#### **HANNOVER**

**HAMBURG** 

Car 478 Pit 31-B

**Hamburg University of Technology** 

Leibniz Universität Hannover

Car 417 Pit 26-A

**ILMENAU** 

Car 471 Pit 31-A

Ilmenau University of Technology

Germany

Germany

HorsePower Hannover e.V. was founded in 2007 by a group of 10 engineering students. Our first events were FSUK and FSG in 2009 with the RacePonyO9, a combustion racecar. Step by step we learned about building an electric racecar. 2016 we build the first autonomous electric racecar. This year, our goal is to finish all dynamic events. To achieve this goal we focused on improving our autonmous system's reliability. Therefore we equipped our electric eH17 with technology for driving



Magazin UploadAfter last year's fire that destroyed our dreams for FSG

2017, we put all energy into renovating our workshop and regaining the

lost equipment. Thanks to the support from our sponsors and fellow FS

teams we were able to recover from the severe setback and embraced

the opportunity to start with new ideas into this Season. Now we are

back on track with a new accumulator a new sensor and processing

setup and the newly developed pneumatic braking system.







=

### PROCESSING UNITS Sintrones ABOX-5000G1 RADAR

#### DRIVERLESS ELECTRIC

FRAME CONSTRUCTION one-piece Monocoque, Aluminium honeycomp-sandwich MATERIAL K200K 1200 CP004 42 (CFRP Prepreg), PAMG-XR1-6.1-1/8-15-N-5056 (Alu Honeycomb)

**OVERALL L / W / H** 2620mm / 1419mm / 1080mm

WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 138kg / 107kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / wheel hub motors / 30kW, 30kW, 30kW, 30kW

COMBINED ACCUMULATOR CAPACITY 6

**BRAKE SYSTEM** Regenerative braking + 4-Disk system

PERFORMANCE OF PUs 2000 GFLOPS

POWER CONSUMPTION OF PUs 120 W CAMERAS 2 x Baumer - VLG-20C.I - 1/1.8

**LIDAR** 2x Ibeo Lux 2010 4 layer scanner, range of 50m, 85 degree field of view

OTHER SENSORS 1x IMU: iNAT-M200-SLC with Range +-450 degrees and +-18g, GPS and RTK support

HIGHLIGHTS OF THE DV SYSTEM Fully redundant electro-pneumatic emergency brake system, self-developed simulation environment with Unreal Engine, computing unit with gpu and gigabit network

#### GÖTEBORG

**Chalmers University of Technology** 

Car 480 Pit 31-C

Sweden

It is the first year for Chalmers Formula Student Driverless and we present a reliable autonomous race car based on the 2017 electric car. The team consists of 15 second year master students: 7 members from last years electric team together with 8 new members with diversified background in both hardware and software engineering. The software platform for this car is a unique platform for Chalmers and all of the software used in the car is self-developed by the team during the past year.









MATERIAL CFRP pre-pregs and Al honeycomb (1/2 and 1







Germany



FRAME CONSTRUCTION Monocoque main section with

MATERIAL carbon fiber sandwich with 10/20mm foam and

**OVERALL L / W / H** 2705mm / 1370mm / 1120mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 87kg / 141kg NUMBER OF MOTORS / LOCATION / MAX POWER 2 / Rear Right, Rear Left / 41kW per Motor **COMBINED ACCUMULATOR CAPACITY 3.774kWh** 

BRAKE SYSTEM 4-Disk system **PROCESSING UNITS** dSpace MicroAutobox II embedded PC, Intel NUC7i7, Nvidia Jetson TX2, STM32 Board

PERFORMANCE OF PUs 1600 GFLOPS POWER CONSUMPTION OF PUs 128 W CAMERAS one StereoLabs ZED Stereocamera, 110°

RADAR n/a

LIDAR Velodyne Puck vlp16 highres, 360 degree Laserscan-

OTHER SENSORS VectorNav VN300 Inertial Navigation

HIGHLIGHTS OF THE DV SYSTEM Dynamic Window Approach, robust cone detection with deep neural network, sensor fusion of camera and LIDAR detections, highly

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#### **KARLSRUHE**

Karlsruhe Institute of Technology

Car 418 Pit 26-B

Germany



KA-Racelng is the Formula Student team of the Karlsruhe Institute of Technology, founded in 2006. Since 2010 we are designing, manufacturing and competing with a FSC and FSE car each year and since last year also with a driverless car for the FSD. The KIT18d is KA-RaceIng's secound fully autnomous racecar and is based our the KIT15e. We would like to thank all our supporters for the enormous help throughout the







FRAME CONSTRUCTION CFRP sandwich monocoque MATERIAL HT and HM fibres, twill and unidirectional plies,

OVERALL L / W / H 2710mm / 1455mm / 1040mm

WHEELBASE / TRACK (Fr / Rr) 1530mm / 1220mm / 1150mm

DRIVERLESS ELECTRIC

WEIGHT WITHOUT DRIVER (Fr / Rr) 120kg / 98kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / Mounted on the chassis / 23kW

**COMBINED ACCUMULATOR CAPACITY 5.2 kWh** BRAKE SYSTEM 4 floating disks and two piston calipers

**PROCESSING UNITS** nvidia gtx 1060, intel i7-6700, self designed main control unit

PERFORMANCE OF PUs 4700 GFLOPS

POWER CONSUMPTION OF PUs  $80\ W$ 

**CAMERAS** 2 Basler dart cameras looking forward/to the side and one Basler dart camera looking back RADAR

LIDAR 4 ibeo LUX 2010 with a total opening angle of 160° OTHER SENSORS xsens IMU Mit G710; novatel PwrPak

HIGHLIGHTS OF THE DV SYSTEM Completely redundandt camera and lidar system, simulation of the whole AS, ability to drive locally but also to create a map and calculate global trajectory, vehicle is optimized for lidar and camera

#### **MÜNCHEN**

**Technical University of Munich** 

Car 431 Pit 28-A

Germany



TUfast Racing Team from the TU Munich consists of 80 team members who design and build two race cars this season as a single team (electric + driverless). One Team - Two cars - TUfast. We believe our state-ofthe-art verifiable trajectory planner and controller, the fast and light 2017 electric car we use as the platform, the self developed perception algorithms and our agile actuation systems will contribute to our success in this season. Feel free to pay us a visit in our pit!









FRAME CONSTRUCTION CFRP Monocoque with alumini-

MATERIAL carbon fibre reinforced plastic OVERALL L / W / H 2933mm / 1417mm / 1176mm

WHEELBASE / TRACK (Fr / Rr) WEIGHT WITHOUT DRIVER (Fr / Rr) 98kg / 90kg

NUMBER OF MOTORS / LOCATION / MAX POWER COMBINED ACCUMULATOR CAPACITY 7.2kWh

**BRAKE SYSTEM** Integrated sintered upright calipers PROCESSING UNITS Intel Xeon

PERFORMANCE OF PUs 756 GFLOPS POWER CONSUMPTION OF PUs 300 W

CAMERAS 2 color global shutter cameras with 8mm lens RADAR n/a

LIDAR Velodyne Ultrapuck

OTHER SENSORS GPS. IMU

HIGHLIGHTS OF THE DV SYSTEM Trajectory guarantees, advanced photometric and laser range mapping, as well as the agile actuation systems allow us to drive quickly and reliably around the track.

#### **MÜNCHEN**

**University of Applied Sciences München** 

Car 413 Pit 25-C

Germany



Autonomous driving vehicles are currently thought to be the future and even if they weren't we would still be taking on this challenge of Formula Student Driverles. We are a small group of technology enthusiasts who see Formula Student as a unique experience and a chance to prove ourselves at the same time, which is why we decided that we wanted to be part of this awesome category!Remember: If you can't win with a driver. you have to do it without.













FRAME CONSTRUCTION Monocoque with tubular Front

MATERIAL CFRP Sandwich Structure with aluminium core **OVERALL L / W / H** 2887mm / 1395mm / 1147mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 108kg / 105kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / Front Right, Front Left, / 28kW

COMBINED ACCUMULATOR CAPACITY 7,3kWh **BRAKE SYSTEM** AP Racing two piston calipers, AP Racing master cylinders 14/22mm

PROCESSING UNITS 2x NVIDIA Jetson TX2, ETAS ES910 PERFORMANCE OF PUs 1500 GFLOPS

POWER CONSUMPTION OF PUs 65 W CAMERAS 2, 25m, 76.5deg, PYTHON RADAR 0

LIDAR 0

OTHER SENSORS 1xSpeedsensor, 1xAccelerationsensor HIGHLIGHTS OF THE DV SYSTEM Self developed C++ libraries vor localization, mapping and trajectorie planning. Single monocular camera for environment detection. Customized neural network for cone detection.

#### **STUTTGART**

**University of Stuttgart** 

Car 426 Pit 26-C

E7000, our first driverless car. What a career for a FS car to be used and

abused three times in a row! Our 15 team members were hard at work

to get the car driving and to not upset the GreenTeam alumni from the

E0711-7 team. As usual our goals have been achieved by the extensive

use of overengineering, gaffer tape and by team members asking ques-

tions like ,Can't the car go testing on it's own? It's autonomous, right!?'.

Germany





**FRAME CONSTRUCTION** one-piece monocoque with tubular steel main roll hoop and aluminium fr-roll hoop MATERIAL CFRP and aluminium honeycomb sandwich **OVERALL L / W / H** 2925mm / 1399mm / 1200mm

WHEELBASE / TRACK (Fr / Rr)

DRIVERLESS ELECTRIC

WEIGHT WITHOUT DRIVER (Fr / Rr) 100kg / 110kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / wheel carriers / 34

**COMBINED ACCUMULATOR CAPACITY 6.8kWh BRAKE SYSTEM** self-developed rotors and adjustable pedalbox, adjustable brake balance

PROCESSING UNITS x86 PC, i5-7500T, GTX1070, Xilinx

PERFORMANCE OF PUs 6000 GFLOPS

POWER CONSUMPTION OF PUs 200 W CAMERAS 2 cameras 60° POV, 2 cameras 100° POV RADAR n/a

LIDAR Velodyne VLP-16

OTHER SENSORS IMU, Optical speed sensor

HIGHLIGHTS OF THE DV SYSTEM Staying within the track limits and minimizing the lap time are our main goals. In order to achieve this we focused the concept of the autonomous system to build a car that is just limited by the physical boundaries and not by the driver.



Norwegian University of Science and Technology

Car 463 Pit 29-A

Norway



Revolve NTNU is a team from Norway, consisting of 70 students from all years of study. We decided early to join the new challenge of driverless and followed closely as the first FSD competition was held in 2017. This year our 20 members on the driverless team have been working hard to place Trondheim on the map of autonomous racing, resulting in a solid system based on the combination of Machine Learning and classical AI.









#### DRIVERLESS ELECTRIC

FRAME CONSTRUCTION Full CFRP monocoque MATERIAL CFRP, AIHC and Rohacell sandwich construc-

**OVERALL L / W / H** 2630mm / 1400mm / 1186mm WHEELBASE / TRACK (Fr / Rr)

WEIGHT WITHOUT DRIVER (Fr / Rr) 73kg / 108kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / FR, FL, RR, RL / 4x37kW

**COMBINED ACCUMULATOR CAPACITY 5,81** 

**BRAKE SYSTEM** Self developed discs (186mm) and brake balance adjuster. ISR front and rear calipers.

PROCESSING UNITS Nvidia Drive PX2 Auto Chauffeur

PERFORMANCE OF PUs 16000 GFLOPS POWER CONSUMPTION OF PUs 150 W

CAMERAS 2 color-vision FLIR Blackfly mounted in main

RADAR N/A

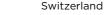
LIDAR Velodyne Puck VLP-16, mounted below monocoque OTHER SENSORS Swift Nav Piksi Multi RTK and Vector

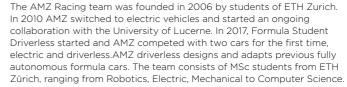
HIGHLIGHTS OF THE DV SYSTEM Both end-2-end machine learning and full driving pipeline. Cone-detection combining LiDAR and camera with ML classifier and YOLO3 as redundant systems. Fully functional graphSLAM, and trackfinder using triangulation and circles. Model Predictive Contouring Control for high speed driving. Early testing with Gazebo and Traxxas XO-1 RC car.

#### **ZÜRICH**

Swiss Federal Institute of Technology Zurich

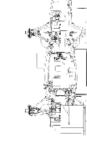
Car 433 Pit 28-B











#### DRIVERLESS ELECTRIC

FRAME CONSTRUCTION CFRP monocoque MATERIAL CFRP pre-preg (twill and UD), aluminium

**OVERALL L / W / H** 2943mm / 1425mm / 1159mm WHEELBASE / TRACK (Fr / Rr) 1530mm / 1220mm / 1220mm

WEIGHT WITHOUT DRIVER (Fr / Rr) 90kg / 85kg NUMBER OF MOTORS / LOCATION / MAX POWER 4 / On the wheel / 29.4 kW

**COMBINED ACCUMULATOR CAPACITY 2.9 kWh** 

 $\ensuremath{\mathbf{BRAKE}}$  SYSTEM 4 CMC (C-SiC) floating disks, adjustable brake balance, AP racing calipers

PROCESSING UNITS PIP 39, Jetson TX2 PERFORMANCE OF PUs 3724 GFLOPS POWER CONSUMPTION OF PUs 120 W

RADAR -

LIDAR Velodyne Hi-Res OTHER SENSORS INS, Absolute Speed Sensor

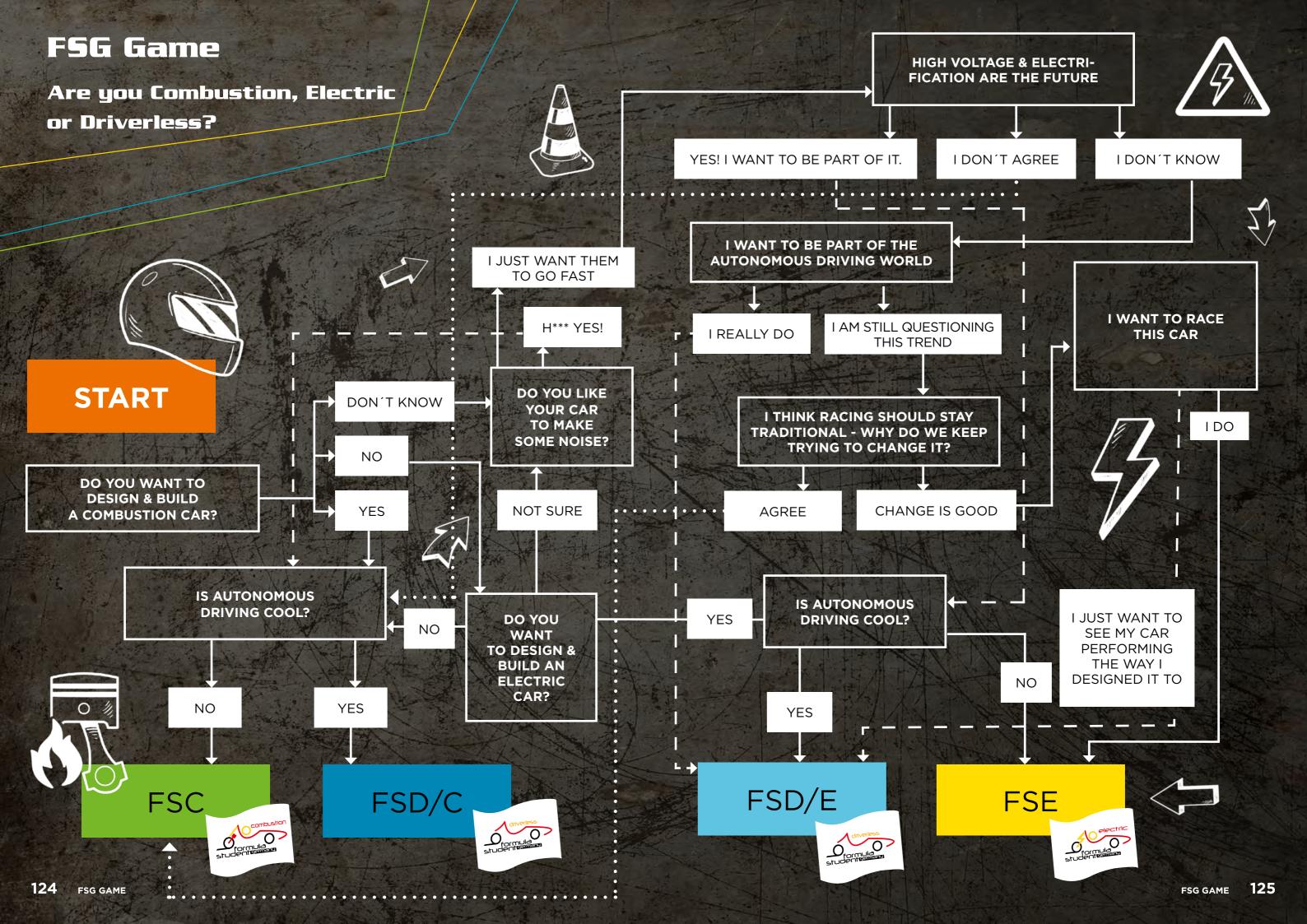
HIGHLIGHTS OF THE DV SYSTEM Fully redundant sensor pipeline, robust against single sensor failure. Combined visual-LiDAR SLAM. Colour independent on-line track boundary estimation. Nonlinear Model Predictive Contou-

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CAMERAS 3 cameras, 20 m range, 2 stereo 1 mono layout







#### How far they come



It is amazing how far the teams are willing to travel and the amount of energy they are willing to invest in order to compete at Formula Student Germany (FSG). Monash Motorsport, from Monash University in Australia explained to us their motivation to travel across continents to be part of the Engineering Design Competition.

#### Please tell us a little bit about the history of your team?

Monash Motorsport was established in the year 2000, and we have been competing in Formula Student competitions In 2018, we will be bringing both our combustion and elecevery year since then. We competed for the first time inter- tric vehicles to compete at Formula Student Germany. We nationally at Formula Student Germany in 2006, and have been attending regularly since 2012. 2017 marked the first time we designed, manufactured and raced with both an at FSG for the first time. electric and combustion car, and will be participating in the 2018 Formula Student Germany competition with both ve- What are the basic steps you go through to prepare the hicles.

#### Do you develop combustion, electric or driverless race early as possible, carefully timelining our design and man-

Our team fields both a combustion and electric car in the Formula Student competition. Our combustion cars have achieved amazing success in recent years winning 8 out of the last 9 Australasian competitions. For the first time in 2017, we also fielded an electric entry to compete at the Formula SAE-Australasia competition and made history by becoming the first Australian team to place first overall in both combustion and electric classes at a single competition. We are also currently in the process of developing our autonomous systems with the aim to produce a functioning and reliable driverless car in 2019.

#### Please give us an overview of the team that will be competing at Formula Student Germany (FSG) 2018?

are bringing with us a team of 40 undergraduate students split across the two cars, most of whom will be competing

#### car for the competition?

We aim to begin preparing our vehicles for competition as ufacturing periods to allow for sufficient vehicle testing and driver training. Our vehicles saw their first drive in July 2017, and following a gruelling initial testing phase leading up to the 2017 Formula SAE-Australasia competition, have been in their second testing phase through the Australian summer of 2018 to shakedown all the new components and systems to ensure their reliability, while also allowing for the final tweaks and tunes to vehicle setup. In the lead up to competition, testing sessions are conducted under realistic competition conditions, with team members taking on their competition specific roles. Sessions often include scrutineering checks, restricted Autocross runs on replica track layouts, full Endurance simulations with timed drivers swaps and strict post-Endurance technical inspections.

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#### How far in advance do you have to ship the car?

How far in advance do you have to ship the car? This year we were fortunate to have been supported by a local company with logistical support - they were

June. This gave us an opportunity to fit in quite a few test- years, together with Edith Cowan University at Silverstone,

ing sessions as well as being able to refine the cars as much as possible in Australia before arriving in Europe.

#### Do you usually test the car once you arrive in Germany?

We are lucky enough to have a number of host teams in Germany to help us setup a workspace, test and maintain our cars when we arrive in Germany. Given the long amount of time taken to ship the cars, we often start testing in Europe as early as possible to shake down the cars and get the drivers back into gear. This year, we will be looking to do some final driver training sessions, and a handful of final tuning tweaks in Germany before competition.

Our team vision is 'to be the most respected Formula Student team in the world'. Competing overseas at FSG and other European competitions helps us to further this goal.

#### Is there any advice you would give to other teams who have not yet made the leap to travel internationally to compete at FSG or any other FS event?

As one of the the only teams to regularly compete in both to organise the shipping date of early May for arrival in late the European and Australasian competitions in recent

> we would absolutely love to see more Aussie teams competing on international soil. Competing internationally not only opens up your team to a huge new Formula Student community, but also allows you to interact with many of the organisers and supporters of the competitions. Of course, you also get to take part in the best part of the Formula Student project multiple times a year too - the competitions!



That being said, logistics are often the most difficult

(and expensive) barrier to teams. We would highly recommend beginning your research early, and aim to lock down your home competition runs off the Formula SAE ruleset. Our team this year has a number of goals for the Formu- ensuring your vehicle meets all the rules requirements of all

> the competitions you plan to attend is absolutely essential too - make sure you don't underestimate the amount of work that this can take!

> Lastly, the European competitions are unique in that they require a grueling quiz registration process typically unseen in other competitions, which requires another level of preparation and team organisation. This year we tackled this challenge by organising practice quizzes for the team,

which resulted in us successfully register-

ing with both our combustion and electric vehicles for all our planned competitions.

#### What is your goal at FSG (to win, meet people, interna- as many logistical points as early as possible. Of course, if

la Student Germany competition. Of course, a strong competition performance in both Static and Dynamic events is always something we strive towards, although we also place focus upon fostering our relationships with the international

tional experience, etc.)?

We would absolutely love to see more "Aussie" teams competing on international soil.

Formula Student community, particularly given we only compete internationally once every two years. We are also looking to provide our young team members with plenty of competition experience during our campaign, to give them 
Do you have anything else you would like to say? the experience to lead the team in years ahead.

#### FSG, what is your motivation to come back?

dent team in the world'. Competing overseas at FSG and shirts - hunt us down before they're all gone! other European competitions helps us to further this goal, by giving us not only an opportunity to compete on the world stage but to further the team's knowledge and appreciation of the competition.

We always look forward to competing in Hockenheim - with such a large number of high quality participating teams and cars, there's so much to learn from. Of course, the great track facilities and brilliant event organisation by the FSG team help too!

We can't wait to catch up with everyone at competition make sure to swing by our pits or campsite to say hi! Un-This is not the first year that your team has competed at fortunately, the Formula Student Germany competition will be the last event of our 2018 European campaign, but this Our team vision is 'to be the most respected Formula Stu- means that many of us will be looking to trade our Monash

#### **EMERGENCY INFORMATION**

#### Minor Injury

#### **Medical Centre:**

Please accompany the injured person to the Medical Centre.

#### Emergency aid is provided there.

The Medical Centre is occupied whenever the Pits are open.

#### Severe Injury

#### Contact someone with a two-way radio:

Every Official and Security has two-way radio.

Ask them to call the Medical Centre or an ambulance on channel 16.

#### Call an ambulance:

Call an ambulance yourself if someone is severely injured and needs urgent help. The Emergency Number for every phone and mobile phone is **112**.

#### **During dynamics:**

On the days that the dynamics are running, an ambulance is on site during the dynamic events.

They are located next to the Medical Centre and are marked on the Event Plan in blue.

To contact them, ask someone with a two-way radio (Official, Security) to call them.

#### **Hospital:**

Krankenhaus (Schwetzingen), Bodelschwinghstrasse 10, 68723 Schwetzingen, phone: +49 (0) 6202/84-30



112

#### **Emergency Numbers**

In case of an emergency call 112.

This number works with each phone, also with mobile phone or coin-operated telephone as international GSM-standard. It is alway free of charge.

#### **Officials**

Pit Marshal - Konrad Paule +49 (151) 560 747 00 Pit Marshal - Sebastian Seewaldt +49 (151) 560 747 01 Event Control - Lea Pißareck +49 (151) 560 747 02

Back Office - Sven Grundner +49 (151) 560 747 02

(In case of an emergency please call one of them, no matter what time it is.)

#### **Emergency Call Contents**

The emergency control centre will ask you some questions to ensure proper help for you. To support you at your call, here are some standard questions and some hints for your answers in English and German.

**Who** is calling? (Wer ruft an?)

Say your name and your telephone number for callbacks. Digits in German: 0 (null), 1 (eins), 2 (zwei), 3 (drei), 4 (vier), 5 (fünf), 6 (sechs), 7 (sieben), 8 (acht), 9 (neun)

Where did it happen? (Wo ist es passiert?/Wo ist es geschehen?)

the event site has the adress "Hockenheimring, Sachshaus, Am Motodrom", make it more precise!: pit lane (Boxengasse), dynamic area (Fahrerlager);

the adress for campsite C2 near the Motodrom Hotel" Hockenheimring, Zeltplatz C2 beim Motodrom Hotel" and for campsite C3 on the other site of the highway "Hockenheimring, Zeltplatz C3 and der Continental Straße"

**What** happened? (Was ist passiert?/Was ist geschehen?)

accident (Unfall), traffic accident (Verkehrsunfall), fire (Feuer), fall (Sturz), explosion (Explosion)

**How many** people are affected? (Wie viele Personen sind betroffen?)

1 (eins), 2 (zwei), 3 (drei), 4 (vier), 5 (fünf), 6 (sechs), 7 (sieben), 8 (acht), 9 (neun), 10 (zehn)

What kind of injury has happened? (Welche Verletzung liegt vor?)

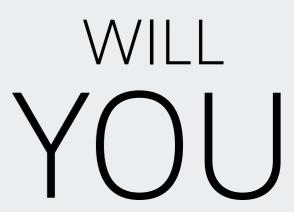
fracture (Knochenbruch), bleeding (Blutung), unconsciousness (Bewusstlosigkeit), burn (Verbrennung), electric shock (Stromschlag), suffocation (Ersticken), heart attack (Herzinfarkt), shock (Schock)

Don't hang up after answering these questions! Wait to hear if the control centre has further questions!

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