MAGAZINE 2023

Formula Student Germany

AN INTERNATIONAL DESIGN COMPETITION OF SKILLS, SPEED AND SPIRIT

14TH - 20TH AUGUST 2023 | HOCKENHEIM

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Seeing beyond

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

Editorial

Jennifer Stratmann
OT Communications

Dear reader,

This year we are hosting Formula Student Germany (FSG) for the 17th time. Different people and generations shaped the era of combustion cars and gave us unforgettable moments. We have captured these emotions for you in some verses (p. 29).

To give the combustion class a suitable farewell, there is a very special highlight this year: the FSG Combustion Reunion. 24 alumni teams have registered with their racing cars to compete against each other for the last time at the Hockenheimring. If you want to look at some of these classic cars in advance, turn to pages 30–36.

Looking to the future, the FSG will be a competition focused on electric concepts and the addition of autonomous components. It is our motivation to move with technological progress and provide an event format for creative approaches. Thanks to our partners from industry, who provide the teams with appropriate software and hardware, among other things, it is possible for the students to learn about the mobility of tomorrow from scratch. We have outlined examples of this close cooperation, from which not only the young professionals but also the companies benefit, for you in this magazine (from p. 24 as well as from p. 46).

Although we love innovative solutions, the safety aspect always comes first: to get through the technical inspection of the race car as smoothly as possible, there are a few general recommendations from our side (p. 86). On the other hand, we reveal how the Cost and Manufacturing Event can be organized successfully in an interview with our the responsible FSG team (p. 80–85).

As you can see, this magazine covers the whole range of FSG topics. Besides the written lines, we hope that the many impressions will give you an insight into our world. In this regard, a big thank you goes to our over 400 volunteers who contribute every year to creating a very special experience for all involved.

Let yourself be carried away by this energy - see you on the racetrack!

Liebe Leserinnen und Leser,

im diesen Jahr veranstalten wir zum 17. Mal die Formula Student Germany (FSG). Verschiedene Studienjahrgänge und Generationen prägten diese Verbrenner Ära und bescherten uns unvergessliche Momente. Diese Emotionen haben wir in einigen Versen für Sie eingefangen (S. 29).

Um die Verbrennerklasse gebührend zu verabschieden, gibt es in diesem Jahr ein ganz besonderes Highlight: die FSG Combustion Reunion. 24 Alumni Teams haben sich mit ihren Rennwagen angemeldet, um ein letztes Mal auf dem Hockenheimring gegeneinander anzutreten. Wenn Sie schon vorab einen Blick auf einige diese Oldtimer werfen wollen, schlagen Sie die Seiten 30–36 auf.

Den Blick in die Zukunft gerichtet, wird die FSG ein Wettbewerb mit Fokus auf den elektrischen Antrieb und der Ergänzung von autonomen Fahrfunktionen sein. Es ist unsere Motivation, uns mit dem technologischen Fortschritt zu bewegen und ein Veranstaltungsformat für kreative Ansätze zu bieten. Dank unseren Partnern aus der Industrie, die den Teams unter anderem entsprechende Soft- und Hardware zur Verfügung stellen, ist es den Studierenden möglich, die Automobilität von morgen von der Pike auf kennenzulernen. Beispiele dieser engen Zusammenarbeit, von dessen Austausch nicht nur die jungen Nachwuchsfachkräfte, sondern auch die Unternehmen profitieren, haben wir für Sie in diesem Magazin skizziert (ab S. 24 sowie ab S. 46).

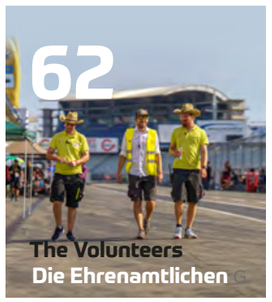
Doch auch wenn wir innovative Lösungen lieben, der Sicherheitsaspekt hat immer Vorrang: Um die technische Abnahme des Rennwagens möglichst reibungslos zu überstehen, gibt es ein paar generelle Empfehlungen unsererseits (S. 86). Wie hingegen die Disziplin Cost and Manufacturing Event erfolgreich gestaltet werden kann, verraten wir in einem Interview mit unseren FSG-Verantwortlichen (S. 80–85).

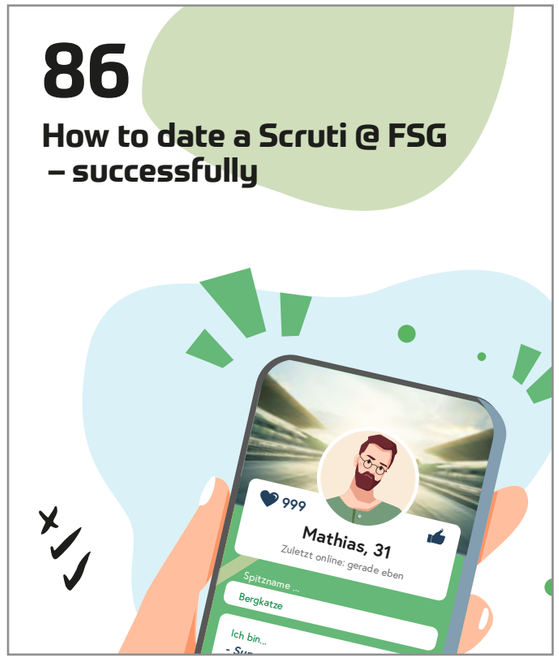
Wie zu erkennen, bildet dieses Magazin die ganze Themenvielfalt der FSG ab. Neben den geschriebenen Zeilen hoffe ich, dass nicht zuletzt die vielen Impressionen Ihnen einen Einblick in unsere Welt ermöglichen. In diesem Sinne gilt ein großer Dank unseren über 400 Freiwilligen, die jedes Jahr dazu beitragen ein ganz besonderes Erlebnis für alle Beteiligten zu gestalten.

Lassen Sie sich von dieser Energie mitreißen – wir sehen uns auf der Rennstrecke!

Content
Inhalt

WiFi: Hockenheimring
Code: hhr@2023





Introduction
Einführung

The Challenge

Formula Student Germany (FSG) is an international design competition based on the Formula SAE rules and guidelines for university students. Teams from around the world have the task of designing a single-seated, formula-style car with either a combustion or electric drive train and manufacturing a functional prototype. Since 2022, the teams must also incorporate autonomous features to complete some dynamic disciplines successfully. This development poses a significant challenge to all teams regarding vehicle design since the prototype must master both scenarios without sacrificing performance in either of them. The teams that are already more advanced in the field of autonomous systems may additionally compete in the Driverless Cup. Along with the technical aspects, the teams are asked to develop a viable business plan demonstrating that their prototype race car product could become a rewarding business opportunity that creates a monetary profit. Other essential aspects of the vehicle include aesthetics, ergonomics, and the use of off-the-shelf components. Experts from the automobile, motorsport, and supplier industry judge the vehicle design, cost, and business plan. The teams can then score points in various static and dynamic events, ultimately deciding the overall ranking of the competition.

Practical Experience

FSG enriches the teaching content of a course of study through experience in teamwork, time, and project management in general, as well as challenging and practical experience in manufacturing and production while paying attention to the practice-oriented requirements relating to profitability 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 an interdisciplinary team, the students learn firsthand how to combine the economic and technical goals of product development. At the same time, they gain expertise in defending the proprietary solutions and asserting these against competing developments.

Herausforderung

Die Formula Student Germany (FSG) ist ein internationaler Konstruktionswettbewerb für Studierende, der sich an dem 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 Elektro- oder Verbrennungsmotor zu konstruieren und einen fahrfertigen Prototyp herzustellen. Seit der Saison 2022 ist die Implementierung eines autonomen Systems in allen Fahrzeugen laut Regelwerk vorgeschrieben, um alle Disziplinen erfolgreich zu absolvieren. Diese Änderung stellt die Teams vor allem mit Blick auf Fahrzeugauslegung vor eine große Herausforderung. Der Prototyp muss für beide Szenarien bestmöglich entwickelt sein, um eine gegenseitige Benachteiligung zu vermeiden. Die Teams, die bereits Erfahrung in der Entwicklung von autonomen Fahrzeugen besitzen, haben zusätzlich die Möglichkeit am Driverless Cup teilzunehmen. Neben den technischen Aspekten müssen die Teams auch einen realistischen Business Plan entwickeln, der zeigt, dass ihr Produkt - ein Prototyp Rennwagen - eine lohnende Geschäftsmöglichkeit sein könnte, die einen finanziellen Gewinn abwirft. Weitere wichtige Aspekte des Fahrzeugs sind Ästhetik, Ergonomie und die Verwendung von Standardkomponenten. Das Fahrzeugdesign, die Kosten und der Business Plan werden von Experten aus der Automobil-, Motorsport- und Zulieferindustrie bewertet. Die Teams können dann in verschiedenen statischen und dynamischen Disziplinen Punkte sammeln, die letztlich über die Gesamtwertung des Wettbewerbs entscheiden.

Praxisnahe Erfahrung

Die FSG bereichert die Lehrinhalte eines Studiums durch Erfahrungen mit Teamarbeit, Zeit- und Projektmanagement im Allgemeinen sowie durch anspruchsvolle und praktische Erfahrungen in den Bereichen Fertigung und Produktion, ohne dabei die praxisorientierten Anforderungen an Wirtschaftlichkeit und Marktrelevanz zu vernachlässigen. Die im Wettbewerb abgefragten Aspekte entsprechen den Anforderungen verschiedener Industriebereiche hinsichtlich Produktneuentwicklungen und sind daher nicht nur für den Fahrzeugbau anwendbar. Durch die Arbeit in einem interdisziplinären Team lernen die Studierenden, die wirtschaftlichen und technischen Ziele einer Produktentwicklung in Einklang zu bringen. Dabei üben sie auch, ihre eigens entwickelten Lösungen zu verteidigen und gegenüber konkurrierenden Entwicklungen durchzusetzen.

An International Design Competition
Ein internationaler Konstruktionswettbewerb

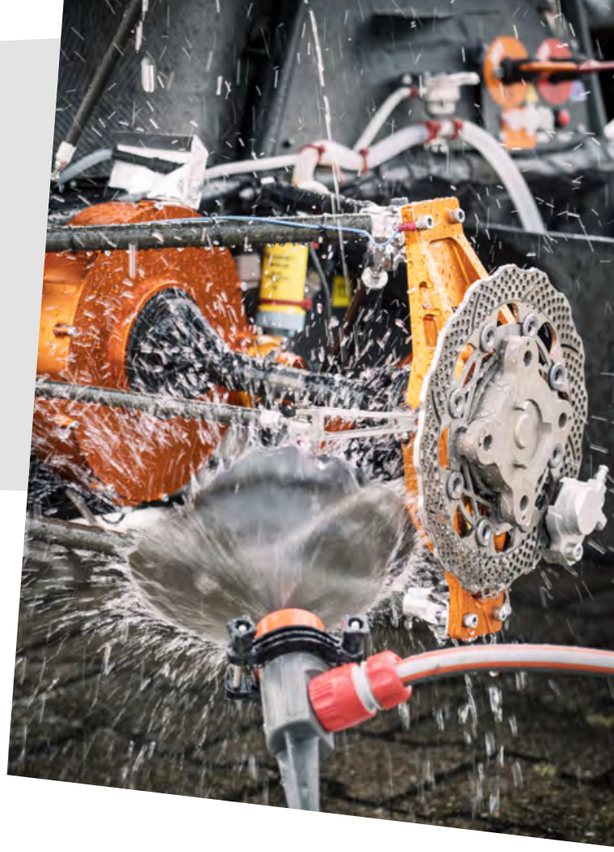
Formula Student Combustion (FSC) / Formula Student Electric (FSE)

Formula Student Germany is an engineering design competition for students. The participants work together as a team to design and manufacture a prototype race car based on a hypothetical manufacturing contract. For the participating teams to be compared, experts judge their designs, plans, and cars. Each team has the chance to win in total a maximum of 1,000 points over the course of static and dynamic events. The team with the best overall combination of design, track performance, financial planning, and marketing strategy will win FSG. In theory, it is possible to win the overall competition without being the best in (or even being eliminated from) one or more events. Similarly, teams can win the top prize in one or more categories and still have a chance at an overall victory.

Die Formula Student Germany ist ein Konstruktionswettbewerb für Studierende, bei dem unter der Annahme eines fiktiven Konstruktionsauftrags der Prototyp eines Rennwagens entsteht. 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 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. Andererseits können durch dieses Bewertungssystem auch Teams einen Titel in einer oder mehreren Disziplinen erringen, jedoch ohne eine Chance auf den Gesamtsieg haben.

The complete FSG Competition Handbook 2023:

https://fsg.one/comp-handb-23



To be allowed to participate in the dynamic disciplines, the race car need to be checked in details / Damit an den dynamischen Disziplinen teilgenommen werden darf, muss der Rennwagen auf Herz und Nieren getestet werden

Static Events

The Formula Student Germany competition is designed to introduce the participating students to the interdisciplinary approach of today's automotive industry. This includes technical understanding and economic and communication abilities such as presentation techniques or financial planning skills. Therefore, the three static events demand collaboration across the team in design and layout, construction, marketing, and product pricing. They also require specialized expertise from different technical and business courses of study. The teams win up to 325 points of the possible 1,000 in the three static events, and each event is weighted differently. A panel of experienced experts from the automobile, motorsport, and supply industries judges the performance of each team.

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 their design and how it will be applied to their chosen construction. Based on this document, the jury members will evaluate the layout, technical innovation, construction, and implementation of the production of the actual vehicle. During a discussion at the event, the teams must prove their knowledge to the judges. It focuses mainly on clarifying technical details, exploring the thinking behind the chosen design, as well as the corresponding technical expertise of the students. The evaluation will not only assess the quality of the technical solution in question but also the reasons behind the concept.

Cost and Manufacturing – 100 points
Cost is a decisive factor in the design of any product. In the cost and manufacturing event, the teams must calculate the expenses 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 the judge's questions about the cost report on their prototype. In addition to considering the thoroughness of the written report, the student's understanding of the manufacturing process and a realistic cost calculation will be assessed.

Business Plan Presentation – 75 points
Each team presents its business plan for the constructed prototype to a fictitious round of investors represented by judges. During a ten-minute presentation, the team must demonstrate why their design best fulfills the demands of their target group 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 discipline, the content, structure, and preparation of the presentation and the teams' performance are assessed, as are the meaningfulness of the business model and the answers to the judges' questions.

Total number of possible points in the static events: 325

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Statische Disziplinen

Der Formula-Student-Wettbewerb soll die teilnehmenden Studierenden 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 werden in drei statischen Disziplinen sowohl die teamübergreifende Zusammenarbeit bei Konzept, Auslegung, Konstruktion, Vermarktung und Preisgestaltung eines Produktes als auch spezielles Fachwissen aus verschiedenen technischen und wirtschaftlichen Studiengängen gefördert und gefragt. In den drei statischen Disziplinen können die Teams maximal 325 Punkte erreichen, wobei die Einzeldisziplinen unterschiedliche Gewichtungen haben. Bewertet werden die Leistungen der Teams durch eine Jury aus erfahrenen Experten der Automobil- und Zulieferindustrie sowie dem Motorsport.

Engineering Design – 150 Punkte
Zu Beginn des Engineering Design-Wettbewerbs reichen die Studierenden eine achtseitige technische Beschreibung zu ihrem Fahrzeug ein, um das Konzept sowie Besonderheiten der Konstruktion darzustellen. Die Jury bewertet auf Basis der Unterlagen das technische Konzept, die Auslegung, Konstruktionen sowie Umsetzung in der Fertigung am realen Fahrzeug. Die Teams müssen ihnen dabei 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 die Gründe für die gewählten Lösungen.

Cost and Manufacturing – 100 Punkte
Die Kosten sind für Gestaltung eines Produktes ein entscheidender Faktor. Bei der Disziplin Cost and Manufacturing müssen sich die Teams mit den kalkulatorischen Größen des Fahrzeugs, seiner Bauteile und der notwendigen Fertigungsschritte auseinandersetzen und diese schriftlich in einem Cost Report festhalten. Zu den eingereichten Unterlagen müssen sich die Studierenden mit ihren Prototypen einer Diskussion mit den Juroren stellen. Bewertet werden neben der Aufbereitung und Vollständigkeit des schriftlichen Reports auch das Verständnis der Fertigungsprozesse sowie eine realistische Kostenkalkulation.

Business Plan Presentation – 75 Punkte
Mit ihrem Business Plan präsentieren die Teams einem potenziellen Investor oder Partner, vertreten durch die Juroren, ihre Geschäftsidee für den gebauten Prototyp. Die Teams stellen in einer zehnminütigen Präsentation dar, weshalb ihr Konzept am besten für die Zielgruppe geeignet ist, und eine gewinnbringende Investition darstellt. Der Präsentation folgt eine fünfminütige Diskussions- und Fragerunde mit den Juroren. Bei dieser Disziplin werden Inhalt, Aufbau und Aufbereitung des Vortrags sowie der Auftritt der Teams ebenso bewertet, wie die Sinnhaftigkeit des Geschäftsmodells und die Antworten auf die Fragen der Juroren.

Gesamtzahl der möglichen Punkte in den statischen Disziplinen: 325

▼ Everything ready to go? / Alles bereit um losfahren zu können?

▸ Even the race cars are incredible fast, it's not only about the speed / Auch wenn die Rennwagen unglaublich schnell sind, geht es nicht nur um Schnelligkeit

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. The car's performance in maximum longitudinal and lateral acceleration, race performance, efficiency, and endurance will be examined and evaluated. With a 2022 rule change, the teams are challenged to complete their runs in Skid Pad and Acceleration with and without a driver. Both attempts will count towards the overall score in each discipline. A maximum of 675 points can be scored over the four dynamic events and the efficiency event.

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Acceleration – 50 points + 75 points driverless
The vehicle's acceleration from a standing start is measured over a 75-meter straight. In addition to traction, the correct engine design is crucial for greater power or the highest possible torque. The fastest cars cross the line in less than four seconds and reach speeds of over 100 km/h by the end of the stretch. A maximum of 50 points can be scored with a driver during the run, whereas 75 points can be achieved for the autonomous run.

Skid Pad – 50 points + 75 points driverless
During the Skid Pad event, the cars must drive a figure 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 the cars use aerodynamics to raise the contact pressure and thus increase lateral acceleration. As with all dynamic events, knocking over any cones results in a time penalty. Like Skid Pad, the run with a driver can collect up to 50 points, and the driverless attempt up to 75 to achieve an overall 125.

Autocross – 100 points
The cars traverse an one kilometer long track in the autocross event with straights, curves, and chicanes. A fast lap time shows 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.

Endurance – 250 points
The endurance race represents a quarter of all available points and is consequently the most important event of the Formula Student Germany competition. The cars must demonstrate their capacity for endurance over a handling track of 22 km. All the prototypes' features are crucial for this event, from acceleration and handling to driving dynamics. The driver's skill is also tested here, as they may only familiarize themselves with the track before the race by walking the course length (Course Walk). Each team gets just a single try, and the drivers must be changed at the halfway point. There can be up to seven cars on the circuit at any given time, so overtaking maneuvers must be performed frequently. Overtaking is signaled by a blue flag and is only permitted at specially marked track sections. A team will receive no points at the end if they are more than a third slower than the fastest team overall.

Efficiency – 75 points
Fuel consumption (FSC cars) or energy consumption (FSE cars) is precisely recorded during the endurance race. However, the absolute fuel and energy consumption is not used to calculate the efficiency score but rather the consumption relative to speed. This prevents teams from driving particularly slowly in the endurance competition to score as highly as possible in the efficiency category.

Total number of possible points in the dynamic events: 675

▲ The Endurance race is the highlight of the FSG with many fans and supporters cheering along / Das Educance-Rennen ist der Höhepunkt der FSG, bei dem viele Fans und Unterstützer mitfiebern

@FormulaStudentG

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STATUS/STAND: **24.07.2023**

Photos

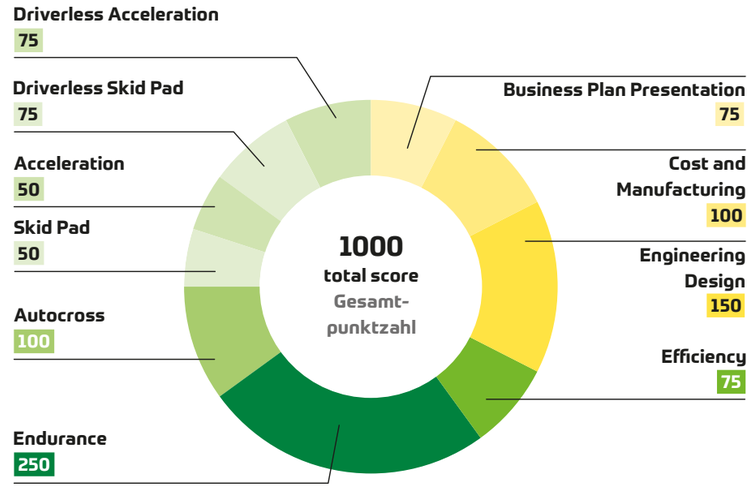
FSG Media: Get access to all the official photos taken by our media team. https://fsg.one/photos23

Dynamische Disziplinen

Die von den Studierenden entwickelten 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 Ausdauer der Rennwagen ermittelt und bewertet. Mit der Regeländerung im Jahr 2022 stellen sich die Teams der Herausforderung, die Disziplinen Skid Pad und Acceleration mit sowie ohne Fahrer zu absolvieren. Beide Versuche fließen dann in die Gesamtwertung ein. In den insgesamt fünf dynamischen Disziplinen können maximal 675 Punkte erzielt werden.

Acceleration – 50 Punkte + 75 Punkte Driverless
Auf einer 75 Meter langen Geraden wird die Beschleunigung der Fahrzeuge aus dem Stand gemessen. Hier kommt es neben der Traktion vor allem auf eine richtige Auslegung des Getriebes und eine möglichst hohe Leistung bzw. ein hohes Drehmoment an. Die schnellsten Fahrzeuge absolvieren diese Prüfung in einer Zeit unter vier Sekunden und erreichen am Ende der Messstrecke Geschwindigkeiten von mehr als 100 km/h. 50 Punkte und 75 Punkte können jeweils für die Versuche mit und ohne Fahrer erreicht werden.

Skid Pad – 50 Punkte + 75 Punkte Driverless
Beim Skid Pad durchfahren die Rennwagen einen mit Pylonen begrenzten Parcours in Form einer 8. Jeder Kreisring wird zweimal umrundet, wobei jeweils die zweite Runde gemessen wird. Die Rundenzeit bietet einen Vergleichswert für die maximal erzielbare Querbeschleunigung der Fahrzeuge. Bei den meisten Fahrzeugen werden durch den Einsatz aerodynamischer Konzepte der Anpressdruck und damit die Querbeschleunigung erhöht. Das Umstoßen von Pylonen wird mit einer Zeitstrafe belegt. Analog zum Beschleunigungsrennen sammeln die Teams jeweils bis zu 50 Punkte für den Runde mit Fahrer und 75 Punkte für den autonomen Versuch, um 125 Punkte zu erreichen.



▲ Point distribution of the dynamic and static disciplines in the classes FSC & FSE at a glance / Punkteverteilung der dynamischen und statischen Disziplinen in den Klassen FSC & FSE im Überblick

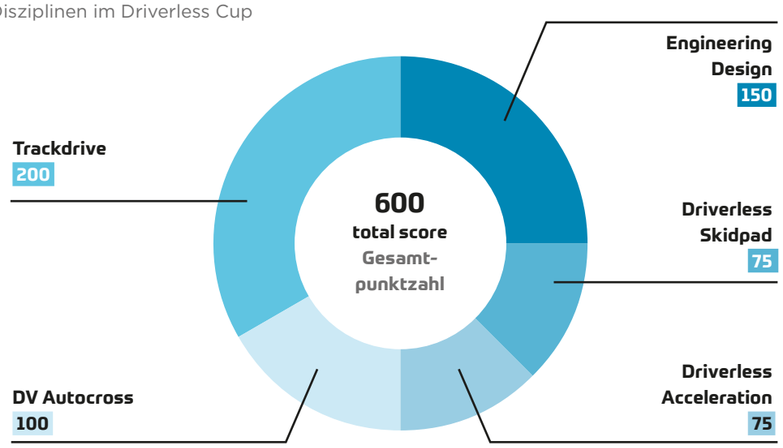
Autocross – 100 Punkte
Bei der Disziplin Autocross fahren die Rennwagen über einen etwa einen Kilometer langen Kurs mit Geraden, Kurven und Schikanen. Eine schnelle Rundenzeit ist ein Indikator für eine hohe Fahrdynamik, ein präzises Handling sowie gute Beschleunigungs- und Bremseigenschaften. Auch hier werden umgestoßene Pylonen mit einer Zeitstrafe geahndet. Die Platzierung im Autocross entscheidet über die Startreihenfolge im nachfolgenden Endurance-Wettbewerb.

Endurance – 250 Punkte
Das Endurance-Rennen stellt mit fast einem Viertel aller erreichbaren Punkte die Hauptdisziplin des Formula-Student-Wettbewerbs dar. Über eine Renndistanz von 22 Kilometern müssen sich die konstruierten Rennfahrzeuge unter Dauerbelastung beweisen. Bei dieser Disziplin sind alle Eigenschaften der Prototypen wichtig, von der Beschleunigung bis zum Handling und der Fahrdynamik. Zusätzlich ist auch das Geschick der Fahrer gefragt, da die Strecke vor dem Rennen nur zu Fuß abgeschritten werden darf (Course Walk). Jedes Team hat einen einzigen Versuch, wobei nach der Hälfte der Distanz ein Fahrerwechsel erfolgen muss. Es sind bis zu sieben Fahrzeuge gleichzeitig auf der Strecke, wodurch es oft auch zu Überholvorgängen kommt. Diese werden von der Rennleitung veranlasst und finden in eigens dafür eingerichteten Überholzonen statt, an denen die Strecke breiter ist. Das langsamere Fahrzeug bekommt dafür von den Streckenposten durch blaue Flaggen signalisiert, dass es einen schnelleren Teilnehmer überholen lassen muss. Die Teams erhalten nur dann Punkte, wenn sie maximal ein Drittel langsamer waren als das schnellste Team. Auch hier werden umgeworfene Pylonen durch Zeitstrafen geahndet.

Efficiency – 75 Punkte
Während des Endurance-Rennens wird der Kraftstoffverbrauch (FSC-Fahrzeuge), bzw. der Energieverbrauch (FSE-Fahrzeuge) gemessen. Bei der Berechnung der Effizienz und der Punkte wird allerdings nicht der absolute Kraftstoff-/Energieverbrauch gemessen, sondern der Verbrauch in Relation zur Geschwindigkeit. Dadurch wird verhindert, dass Teams während des Endurance-Wettbewerbs besonders langsam fahren, um eine möglichst hohe Punktzahl in der Efficiency-Disziplin zu erreichen.

Gesamtzahl der möglichen Punkte in den statischen Disziplinen: 675

▾ Point distribution of the dynamic and static disciplines in the Driverless Cup / Punkteverteilung der dynamischen und statischen Disziplinen im Driverless Cup



▲ Finalists present their race car in the discipline Engineering Design / Die Finalisten präsentieren ihren Rennwagen in der Disziplin Engineering Design

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https://fsg.one/in

Driverless Cup

With the merger of the Formula Student Driverless class (FSD) into FSE and FSC, the next important step of the strategy to integrate autonomous driving into FSG was realized in 2022. While some teams may have previous experience with autonomous cars thanks to their participation in FSD, most teams start with their basic autonomous system development. To balance these different experience levels, the Driverless Cup (DC) was created. In the DC the teams can put their advanced level of autonomous driving to the test and gain up to 600 points to win the additional trophy. Dedicated dynamic disciplines must be completed when competing with the same vehicle and team. Moreover, during the Engineering Design Event the teams are challenged on their deep understanding by the industry experts and gain extra points that count towards the over DC score.

Mit der Zusammenführung der Formula-Student-Driverless-Klasse (FSD) mit FSE und FSC wurde 2022 der nächste wichtige Schritt der Strategie zur Integration des autonomen Fahrens in die FSG umgesetzt. Während einige Teams dank ihrer Teilnahme an der FSD bereits Erfahrung mit autonomen Fahrzeugen haben, beginnen die meisten Teams mit der grundlegenden Entwicklung ihres autonomen Systems. Um diese unterschiedlichen Erfahrungsstufen auszugleichen, wurde der Driverless Cup (DC) ins Leben gerufen. Im DC können die Teams ihr fortgeschrittenes Niveau des autonomen Fahrens unter Beweis stellen und bis zu 600 Punkte sammeln, um die zusätzliche Trophäe zu gewinnen. Mit demselben Fahrzeug und demselben Team müssen spezielle dynamische Disziplinen absolviert werden. Darüber hinaus werden die Teams während des Engineering Design Events von Branchenexperten zu ihrem tiefen Verständnis herausgefordert und erhalten zusätzliche Punkte, die in die Gesamtwertung des Driverless Cup einfließen.

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▾ Pure joy after receiving the trophy presentation at the Award Ceremony / Pure Freude nach der Entgegennahme der Trophäe bei der Award Ceremony

▸ Static Disciplines

Since the teams compete with the same car in the Driverless Cup the cost and business plan should not be judged separately. Only during the Engineering Design Event, the team's advanced understanding of the autonomous system is put to the test.

Engineering Design – 150 points
The teams that participate in the DC are evaluated by the judges based on a slightly different allocation of points. More focus is on autonomous functionality, low voltage electrics, and electronics.

Total: 150 points

▸ Statische Disziplinen

Da die Teams beim Driverless Cup mit demselben Auto antreten wie in der FSE/FSC Klasse, müssen die Kosten und der Business Plan nicht getrennt bewertet werden. Lediglich im Engineering Design Event wird das fortgeschrittene Verständnis des Teams für das autonome System auf die Probe gestellt.

Engineering Design – 150 Punkte
Die Teams, die am DC teilnehmen, werden von den Juroren auf der Grundlage einer etwas differenzierten Punkteverteilung bewertet. Es wird mehr Wert auf die autonome Funktionalität und die Niederspannungselektrik und -elektronik gelegt.

Gesamtpunktzahl: 150 Punkte

▸ Dynamic Disciplines

The driverless, dynamic disciplines Skid Pad, Acceleration, Autocross, and Trackdrive make up the remaining 450 points.

Acceleration – 75 points,
Skid Pad – 75 points,
Autocross – 100 points

These disciplines test the car's autonomous capabilities with regard to acceleration, handling, and steering. The setup is identical to the events at FSC and FSE.

Trackdrive – 200 points
The autonomous vehicles will race in a Track Race over ten laps on a 200 to 500-meter-long coned course.

Total: 450 points

▸ Dynamische Disziplinen

Die autonomen, dynamischen Disziplinen Skid Pad, Acceleration, Autocross und Trackdrive machen die restlichen 450 Punkte aus.

Acceleration – 75 Punkte,
Skid Pad – 75 Punkte,
Autocross – 100 Punkte

In diesen Disziplinen werden die autonomen Fähigkeiten des Autos in Bezug auf Beschleunigung, Handling und Lenkung getestet. Das Setup ist identisch mit den Disziplinen der FSC und FSE.

Trackdrive – 200 Punkte
Die autonomen Fahrzeuge fahren in einem Trackrace über zehn Runden auf einem 200 bis 500 Meter langen, durch Pylonen markierten, Kurs.

Gesamtpunktzahl: 450 Punkte

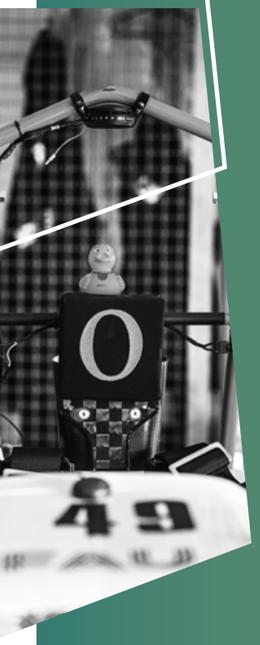
Safety Regulations

Sicherheit und Regeln

As all the vehicles are prototypes, the teams must comply with several safety measures and rules. This also ensures equal opportunities between the teams, which all start the race with different prerequisites regarding experience, personnel capacities, and financial resources. Completing the so-called scrutineering (technical inspection) is the basic prerequisite for a vehicle to be admitted to the dynamic disciplines. The teams receive a sticker for each completed check which is then affixed to the vehicle. For FSC and FSE, there are differences in operational safety that must be considered during scrutineering. Due to the introduction of autonomous components in FSC and FSE, each team must also meet some special requirements.

Each vehicle must have a so-called RES (Remote Emergency System), which fulfills two functions. First, this remote control can trigger the required Emergency Braking System (EBS) and stop the vehicle in an emergency. At the same time, it enables the "Go" signal to be sent to the car at the start of dynamic disciplines. In addition, all vehicles are equipped with different colored signal lamps, which indicate the respective operating status of the vehicle. In autonomous mode, a yellow signal lights up, while a blue light indicates the termination of the mission. These systems must be tested 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 alle mit unterschiedlichen Voraussetzungen in Bezug auf Erfahrung, personelle Kapazitäten und finanzielle Ressourcen an den Start gehen. Das erfolgreiche Absolvieren des sogenannten Scrutineerings (technische Abnahme) ist die Grundvoraussetzung für die Zulassung eines Fahrzeugs zu den dynamischen Disziplinen. Für jeden erfolgreich absolvierten Check erhalten die Teams einen Aufkleber, der auf dem Fahrzeug angebracht werden muss. Bei FSC und FSE gibt es Unterschiede bei der Betriebssicherheit, die beim Scrutineering berücksichtigt werden müssen. Aufgrund der Einführung der autonomen Komponenten in FSC und FSE muss jedes Team auch hier einige besondere Anforderungen erfüllen. Jedes Fahrzeug muss mit einem sogenannten RES (Remote Emergency System) ausgestattet sein, welches zwei Funktionen erfüllt. Zum einen kann mit dieser Fernbedienung das erforderliche Notbremssystem (EBS) ausgelöst und das Fahrzeug in Notsituationen angehalten werden. Gleichzeitig wird ermöglicht, dass das „Go"-Signal zu Beginn der dynamischen Disziplinen an das Fahrzeug gesendet werden kann. Darüber hinaus sind alle Fahrzeuge mit verschiedenfarbigen Signallampen ausgestattet, welche den jeweiligen Betriebszustand des Fahrzeugs anzeigen. Im autonomen Modus leuchtet ein gelbes Signal, während ein blaues Licht den vorzeitigen Abbruch der Mission anzeigt. Diese Systeme müssen während des Scrutineering getestet werden.



Accumulator (only FSE)
The Accumulator is the technical term for the vehicle battery. It consists of a large number of cells connected in series or parallel. The accumulator is the only energy source for electric Formula Student vehicles that powers the car. Therefore, the correct design of the component is essential for vehicle safety. The batteries are thoroughly tested before the dynamic disciplines to avoid possible malfunctions and failures. Overheating the cells can cause a fire, therefore, FSG scrutineers install temperature sensors to accurately monitor the cell temperature. The transport of the batteries outside the vehicle and the charging must be done on special transport trolleys, which can be quickly removed in case of emergency.

Electrical Inspection (only FSE)
During the Electrical Inspection, the electrical safety of the electric vehicles is checked, i.e., all systems prescribed by the regulations are tested for their functionality. The systems tested include insulation monitoring, the correct functioning of the signal light (Tractive System Active Light, which indicates the activity of the high-voltage system), and the signal sound that indicates the vehicle is ready to drive (Ready To Drive Sound). However, all general safety aspects are also checked, such as mechanically flawless wiring and installation of the high-voltage battery in compliance with regulations.

Batterie (nur FSE)
Der Akkumulator, kurz Akku, ist der technische Fachbegriff für die Fahrzeugbatterie. Dieser besteht aus einer Vielzahl an Zellen, die in Reihe oder parallel geschaltet 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 Temperatursensoren durch die FSG Scrutineers angebracht werden. Der Transport der Akkus außerhalb des Fahrzeuges sowie das Laden muss auf speziellen Transportwagen geschehen, welche im Notfall schnell abtransportiert werden können.

Electrical Inspection (nur FSE)
Während der Electrical Inspection wird die elektrische Sicherheit der Elektrofahrzeuge überprüft. D. h. alle durch das Regelwerk vorgeschriebenen Systeme werden auf ihre Funktionsfähigkeit getestet. Zu den geprüften Systemen gehören u.a. die Isolationsüberwachung, die korrekte Funktionsweise des Signallichts (Tractive System Active Light, das die Aktivität des Hochvoltsystems anzeigt) und der Signalton, der die Fahrbereitschaft des Fahrzeugs signalisiert (Ready To Drive Sound). Es werden aber auch allgemeine Sicherheitsaspekte wie z. B. mechanisch einwandfrei verlegte Leitungen oder der regelkonforme Einbau des Hochvolt-Akkus überprüft.

▸ During the technical inspection, the vehicle is tested for safety and compliance with the rules / Bei der technischen Abnahme wird das Fahrzeug auf Sicherheit und Einhaltung des Regelwerks geprüft

◂ One of the mandatory safety checks: the tilt table test / Einer der obligatorischen Sicherheitschecks: der Tilt Table Test (Neigungswinkel-Test)

Tech and Safety (FSC and FSE)
During this inspection, all safety-relevant components and accessories of the race car, prescribed by the regulations, are tested. These include, among other things, the frame structure, wheel suspension, steering, brakes, rims, and tires. Details such as the routing of the fuel lines, the attachment of the intake system, compliance with the cockpit size, or the correct functioning of the emergency switches are also checked. In addition, all drivers must demonstrate that they are in a ready-to-ride condition, i.e. fully dressed and wearing a seat belt, they can exit the car within five seconds.

Tilt Table (FSC and FSE)
The tilt table test checks that no operating fluids are leaking and that the rollover protection regulations are being met. The vehicles must be brought to the test ready to start, with all fluids and a full gas tank. The car with the driver strapped in is tilted to an angle of 60 degrees. This corresponds to a lateral acceleration of 1.7 g. At this angle, no fuel or other liquids may leak out. Only if the upper wheels remain on the ground does the race car pass the tilt table test.

Tech and Safety (FSC und FSE)
Bei dieser Abnahme werden alle sicherheitsrelevanten Bau- und Zubehörteile des Rennwagens, die durch das Regelwerk vorgeschrieben sind, geprüft. Dazu gehören unter anderem die Rahmenstruktur, die Radaufhängung, Lenkung, Bremsen, Felgen und Reifen. Auch Details wie die Verlegung der Kraftstoffleitungen, die Befestigung des Ansaugsystems, die Einhaltung der Cockpitgröße oder die korrekte Funktionsweise der Notschalter werden geprüft. Zusätzlich müssen alle Fahrer zeigen, dass sie in einem fahrfertigen Zustand, d. h. voll eingekleidet und angegurtet, das Auto innerhalb von fünf Sekunden verlassen können.

Tilt Table (FSC und FSE)
Beim Tilt-Table-Test wird überprüft, ob keine Betriebsflüssigkeiten austreten und die Regularien zum Überrollschutz erfüllt werden. Die Fahrzeuge müssen startklar, mit allen Flüssigkeiten und vollgetankt, zum Test gebracht werden. Das Fahrzeug mit angeschnalltem Fahrer wird bis zu einem Winkel von 60 Grad geneigt. Dies entspricht einer Querbeschleunigung von 1,7 g. Bei diesem Winkel dürfen kein Kraftstoff oder andere Flüssigkeiten austreten. Nur wenn die oberen Räder auf dem Boden bleiben, besteht der Rennwagen den Tilt-Table-Test.

▲ After successfully passing the technical inspection, the teams are allowed to participate in the dynamic disciplines / Nach erfolgreich bestandener technischer Abnahme dürfen die Teams an den dynamischen Disziplinen teilnehmen

Noise Test (only FSC)
The Noise Test checks whether the vehicle complies with the noise level regulations. For this purpose, the noise level is measured with the engine running at an idle speed prescribed by the engine design. The noise level must not exceed 103 dBC at idle and 110 dBC at the specified speed.

Rain Test (only FSE)
Rain can lead to critical situations for electric vehicles. For the FSE vehicles to drive unconditionally even in precipitation, they must undergo an artificial rain shower. During the artificial sprinkling of the vehicle, with the high-voltage system activated, it is checked whether the components used are sufficiently insulated and protected against rain.

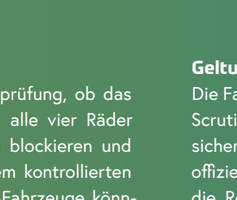
Noise Test (nur FSC)
Der Noise Test überprüft, ob das Fahrzeug den Vorschriften für die Einhaltung des Lärmpegels entspricht. Dazu wird bei laufendem Motor im Leerlauf und bei einer durch die Bauart des Motors vorgeschriebenen Drehzahl die Lautstärke gemessen. Der Lärmpegel darf dabei im Leerlauf nicht höher als 103 dBC und nicht höher als 110 dBC bei der vorgeschriebenen Drehzahl sein.

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 Hochvolt-System kontrolliert, ob die verwendeten Komponenten ausreichend isoliert und gegen Regen geschützt sind.

Brake Test & EBS Test (FSC and FSE)
The brake test checks whether the braking system can lock all four wheels of the vehicle simultaneously, bringing the car to a controlled stop. The FSE vehicles could also use the electric drive for braking. However, to demonstrate proper operation of the mechanical braking system in the event of a fault in the high-voltage system, the driver must deactivate it after accelerating and then come to a stop with four wheels locked. Due to the integration of driverless functions in FSC and FSE, vehicles must now also pass the emergency braking test by the Emergency Braking System (EBS), in which the vehicle must be brought to a halt by the Remote Emergency System (RES).

Adherence to the Rules
The vehicles must always comply with the rules and safety requirements, even after passing scrutineering. The official technical experts or the race control may temporarily disqualify cars from the competition at any time in case of a breach of the regulations or safety requirements, e.g., if liquids are leaking, the vehicle is too noisy, or the electrical insulation is not guaranteed. Vehicles will be allowed to compete again once the defect has been corrected. After the Endurance race, the vehicles will be rechecked to exclude rule violations during the race. For this purpose, the vehicles will be parked in a "parc fermé" and may not be touched by team members until the final inspection.

▶ The safety of the accumulator is tested in detail / Die Sicherheit des Akkumulators wird ausführlich geprüft



Brake Test (FSC und FSE)
Der Bremstest dient zur Überprüfung, ob das Bremssystem in der Lage ist, alle vier Räder des Fahrzeugs gleichzeitig zu blockieren und dadurch das Fahrzeug zu einem kontrollierten Stillstand zu bringen. Die FSE-Fahrzeuge könnten auch den elektrischen Antrieb zum Bremsen verwenden. Um jedoch eine einwandfreie Funktion des mechanischen Bremssystems bei einem Fehler im Hochvolt-System nachzuweisen, muss der Fahrer dieses nach dem Beschleunigen deaktivieren und anschließend mit vier blockierenden Rädern zum Stehen kommen. Aufgrund der Integration der fahrerlosen Funktionen in FSC und FSE müssen die Fahrzeuge nun auch die Notbremsprüfung durch das Emergency Braking System (kurz EBS) absolvieren, bei der das Fahrzeug durch das ferngesteuerte Notfallsystem (Remote Emergency System, RES) zum Stillstand gebracht werden muss.

Geltungsbereich
Die Fahrzeuge müssen auch nach bestandenem Scrutineering zu jeder Zeit regelkonform und sicherheitstechnisch unbedenklich sein. Die offiziellen technischen Sachverständigen oder die Rennleitung können Fahrzeuge bei einem Verstoß gegen das Reglement oder die Sicherheitsanforderungen jederzeit temporär vom Wettbewerb disqualifizieren, 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 Mangel behoben wurde. Nach dem Endurance-Rennen werden die Fahrzeuge erneut geprüft, um Regelverstöße während des Rennens ausschließen zu können. Hierfür werden die Fahrzeuge in einem „Parc-Fermé" abgestellt und dürfen von den Teammitgliedern solange nicht mehr berührt werden, bis die letzte Abnahme erfolgt ist.

▸ Flags

During the dynamic events, flags are used to communicate with the drivers. The various colours and patterns have different meanings, and all drivers must understand and obey any flag signal they receive during the competition. Infringements of flag signals can be penalised with various penalties, ranging from time penalties to disqualification.

▸ Flaggen

Bei den dynamischen Disziplinen werden zur Kommunikation mit den Fahrern Flaggen eingesetzt. Die verschiedenen Farben und Muster haben unterschiedliche Bedeutungen. Alle Fahrer müssen die Flaggen kennen und beachten, wenn sie diese während des Wettbewerbs gezeigt bekommen. Verstöße gegen geschwenkte Flaggen können mit verschiedenen Sanktionen geahndet werden, die von Zeitstrafen bis zur Disqualifikation reichen können.

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. Halte am Rand der Strecke.

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!

Something has happened beyond the flag station. No passing unless directed by the track marshals. Stationary: Danger! Slow down, be prepared to take evasive action. Waved: Great Danger! Slow down, evasive action is most likely required, be prepared to stop.
Etwas ist hinter der Flagge passiert. Fahr 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.

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

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

▸ Successfully crossing the finish line / Erfolgreiche Überquerung der Ziellinie

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It's all about data
Alles dreht sich um Daten

Written by Philipp Bandow & Philipp Rossak

With the new strategic orientation of Formula Student from a combustion-focused competition to electrically driven and autonomous racing cars, dataloggers are elementary in order to be able to organize the event safely and in accordance with the rules. In close cooperation with partners from the industry, Formula Student Germany provides the teams with the necessary components. This technically oriented article will show how the dataloggers are constructed and which functions are necessary to ensure data acquisition.

Durch die neue strategische Ausrichtung der Formula Student vom Verbrenner-fokussierten Wettbewerb hinzu elektrisch angetriebenen und autonomen Rennwagen, sind Datenlogger elementar um das Event sicher und regelkonform ausrichten zu können. In enger Zusammenarbeit mit Partnern aus der Industrie stellt die Formula Student Germany den Teams die notwendigen Komponenten zur Verfügung. Wie genau die Datenlogger aufgebaut sind und welche Funktionen vonnöten sind, um die Datenerfassung sicherzustellen, erfahren Sie in diesem technisch orientierten Artikel.

Overview

The FS datalogger is a device a that is placed in every autonomous and every electric vehicle taking part in Formula Student competitions. It is used to record the energy consumption of electric vehicles and control data from autonomous vehicles, to ensure the power limits are met, to score energy efficiency and to analyze autonomous system characteristics.

Übersicht

Der FS-Datenlogger ist ein Gerät das in jedem elektrischen oder autonom fahrenden Fahrzeug während der Teilnahme an Formula Student Events verbaut wird. Er wird genutzt, um den Energieverbrauch der Fahrzeuge und Trajektoriendaten des autonomen Systems aufzuzeichnen sowie die Einhaltung von Leistungslimitierung zu überprüfen.

The main objective for starting the development of a new datalogger was to address the challenges posed by the increasing count of vehicles participating in Formula Student and the maintenance intensive approach that was chosen previously. In the end, the energy measurement concept is the only thing that remained the same. The datalogger still incorporates a Isabellenhütte IVT-MOD for current and voltage sensing of the tractive system. Further requirements include the ability to power the datalogger via IEEE 802.3af PoE inside its custom-built transport boxes, to ensure rapid setup and minimal work on-site.

Der Hauptgrund für die Entwicklung eines neuen Datenloggers war die Bewältigung der Herausforderungen ein stetig wachsendes Event auszurichten. Zudem war der Ansatz des vorherigen Datenloggers vergleichweise wartungsintensiv. Alles in allem ist nur das Konzept hinter der Energiemessung geblieben. Im Datenlogger ist nach wie vor ein IVT-MOD der Isabellenhütte für die Strom- und Spannungserfassung des Antriebssystems integriert. Zu den weiteren Anforderungen gehört die Möglichkeit, den Datenlogger über IEEE 802.3af PoE in den speziell angefertigten Transportboxen mit Strom zu versorgen, um einen schnellen Aufbau und minimalen Aufwand vor Ort zu gewährleisten.

Hardware

The core of the datalogger is the Toradex Colibri iMX8QXP. A custom carrier board connecting it to all external interfaces was developed to integrate it into a casing with very similar dimensions to the previous generation. A multi-rail power supply with a wide range of 12V to 60V DC generates the voltages required to power the logger and its components. All the voltage rails are monitored on the M4 coprocessor of the iMX8QXP SOM, to rapidly react to supply spikes. A real time clock, powered by a super capacitor, is used to provide accurate timestamps for the generated logfiles.

Hardware

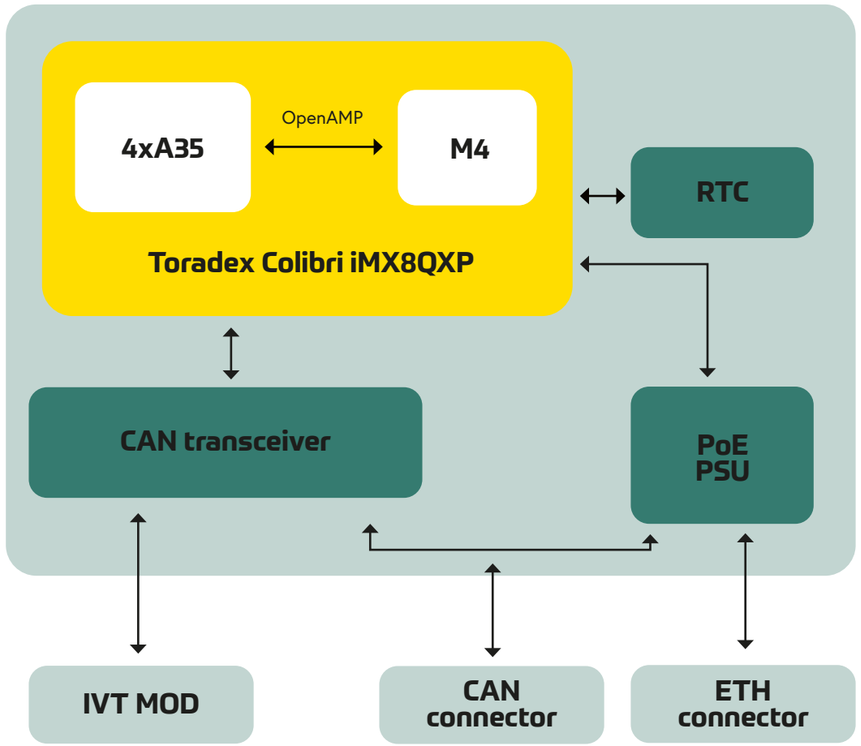
Das Herzstück des Datenloggers ist der Toradex Colibri iMX8QXP. Um ihn in ein Gehäuse zu integrieren, das annähernd die Abmessungen der Vorgängergeneration hat, wurde eine eigene Trägerplatine entwickelt, die alle externen Schnittstellen ansteuert. Eine Multi-Rail Stromversorgung mit einem weiten Eingangsspannungsbereich von 12V bis 60V DC erzeugt die für die Versorgung des Loggers und seiner Komponenten erforderlichen Spannungen. Alle Spannungsschienen werden vom M4-Coprozessor des iMX8QXP SOM überwacht, um schnell auf Spannungsspitzen reagieren zu können. Eine Echtzeituhr, die von einem Superkondensator gespeist wird, dient zur genauen Zeitstempelung der erzeugten Logdateien.

Logger Software

On the iMX8QXP we use a custom Yocto Linux distribution with a mainline Linux kernel. The custom software stack is split into multiple components: The embedded firmware runs on the M4 coprocessor and handles all of the real-time measurements. It communicates with the main processor via OpenAMP. The main processor uses an update module for easy updates of the logging software. This main logging software stores and manages all of the recorded data. Data integrity is ensured via cryptographic signatures. All of the loggers share a backend service running online to exchange configuration, logging and telemetry data. The whole operating system can be updated over-the-air (OTA), with automatic rollbacks and A/B partitions to ensure a safe state.

Logger Software

Auf dem iMX8QXP verwenden wir eine speziell entwickelte Yocto-Distribution mit einem Mainline-Linux-Kernel. Der Software-Stack ist in mehrere aufgeteilt: Die eingebettete Firmware wird auf dem M4 Coprozessor ausgeführt und ist zuständig für die Echtzeitmessungen. Sie kommuniziert mit dem Hauptprozessor via OpenAMP. Auf dem Hauptprozessor läuft ein Aktualisierungsmodul für einfache Updates der Hauptsoftware. Die Hauptsoftware speichert und verwaltet alle aufgezeichneten Protokollierungsdaten. Die Dateninteгrität wird durch kryptografische Signaturen sichergestellt. Alle Logger teilen sich einen online laufenden Backend-Dienst, mit dem sie ihre Konfiguration sowie Log- und Telemetriedaten austauschen. Das gesamte Betriebssystem kann Over-the-Air (OTA) aktualisiert werden, mit automatischen Rollbacks und A/B-Partitionen, um stets einen funktionsfähigen Zustand zu gewährleisten.



We would like to thank all the sponsors and supporters that made it possible to build these Dataloggers, especially Toradex for providing us with the iMX8QXP SOM and Isabellenhütte for providing us with the IVT-MOD sensors.

Wir möchten uns bei allen Sponsoren und Unterstützern bedanken, die den Bau dieser Datenlogger ermöglicht haben, insbesondere bei Toradex für die Bereitstellung des iMX8QXP SOM und Isabellenhütte für die Bereitstellung der IVT-MOD-Sensoren.

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An era comes to an end
Eine Ära geht zu Ende

Written by Theresa Stach & Carsten Wilhelm

When the first automobiles drove noisily and smokily through the country at the end of the 19th century, they were still smiled at. This quickly changed, and more and more vehicles conquered the world's roads. The internal combustion engine was established and has been part of our everyday lives for over 100 years.

Als die ersten Automobile Ende des 19. Jahrhunderts lärmend und qualmend durchs Land fuhren, wurden sie noch belächelt. Das änderte sich schnell und immer mehr Fahrzeuge eroberten die Straßen der Welt. Dabei setzte sich der Verbrennungsmotor durch und begleitet unseren Alltag seit über 100 Jahren.

And who doesn't know - especially in motor sports - that goosebump moment when the vehicles are standing at the start-finish line, the engines roar, and the spectators listen rapt with attention.

Und wer kennt es nicht – gerade im Motorsport - diesen Gänsehautmoment, wenn die Fahrzeuge an der Start-Ziel-Geraden stehen, die Motoren aufheulen und die Zuschauer gebannt lauschen.

The cylinders are flooded, and the roar of the exhaust mingles with the cheers of the spectators. At the same time, the smell of burnt gasoline and oil rises and fills the air. You can literally feel the power of the engine pulsing through the vehicle and the sound waves massaging the auricles of the audience. When the crowd finally starts moving, the squeal of the tires, the howl of the straight-toothed racing gearboxes and the slam of the gearshifts complete the soundscape. A unique atmosphere.

Die Zylinder werden geflutet und das Dröhnen der Auspuffanlage mischt sich in das Jubeln der Zuschauer. Gleichzeitig steigt der Duft von verbranntem Benzin und Öl auf und erfüllt die Luft. Es ist förmlich zu spüren, wie die Kraft des Motors durch das Fahrzeug pulsiert und die Schallwellen die Ohrmuscheln des Publikums massieren. Wenn der Pulk sich schließlich in Bewegung setzt, macht das Quietschen der Reifen, das Heulen der geradeverzahnten Renngetriebe sowie das Knallen der Schaltvorgänge die Geräuschkulisse komplett. Eine einzigartige Atmosphäre.

We as FSG want to keep this nostalgic moment in good memory and would like to revive exactly this atmosphere as well as the fascinating engineering performance behind it, which has developed unbelievably over the last decades, one last time at Formula Student Germany.

Solch nostalgischen Moment behalten auch wir als FSG in guter Erinnerung und möchten genau diese Atmosphäre sowie die dahinterstehende faszinierende Ingenieursleistung, die sich über die letzten Jahrzehnte unglaublich weiterentwickelt hat, ein letztes Mal auf der Formula Student Germany aufleben lassen.

To this moment we would like to solemnly dedicate an ode about the four-stroke engine.

Diesem Moment möchten wir feierlich eine Ode über den Viertaktmotor widmen.

An ode to the combustion engine

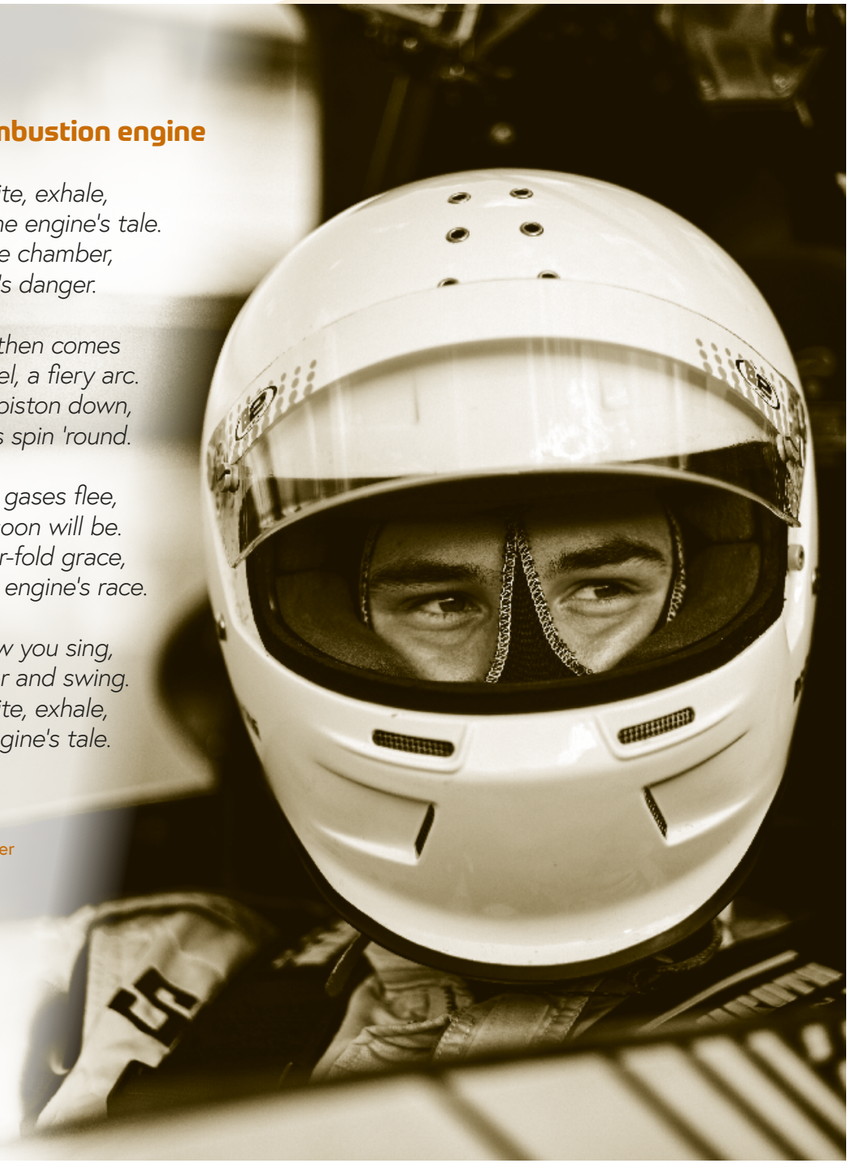
Inhale, compress, ignite, exhale,
The four strokes of the engine's tale.
Fuel and air mix in the chamber,
Piston rises, pressure's danger.

Compression builds, then comes
The spark, igniting fuel, a fiery arc.
Explosion drives the piston down,
Power surges, wheels spin 'round.

Exhaust valve opens, gases flee,
The cycle ends, but soon will be.
Another round of four-fold grace,
The heartbeat of the engine's race.

Viertaktmotor, oh how you sing,
A symphony of power and swing.
Inhale, compress, ignite, exhale,
The rhythm of the engine's tale.

(Source: Due to lack of poetry writing – ChatGPT)
(Quelle: Aufgrund mangelnder Dichtkünste ChatGPT)



FSG Combustion Reunion

Written by Catherina Schiffter

17 YEARS

A tribute to 17 great years of FS combustion racing at FSG

2023 marks a particular year for FSG. It is not only the 17th time we have met in Hockenheim, but it is also the last year of the Combustion class. Therefore, we have invited 24 Alumni teams to compete in the FSG Combustion Reunion. We are happy to welcome cars that participated in the years 2006 to 2017 in a Formula Student competition. The teams, composed each of five alumni, showcase their beauties and will prove that their cars are maybe "old" but still gold.

Like every good old timer in Germany, the car number is registered with an "H" to mark these special competitors.

The Combustion Reunion officially starts on Thursday with a separate technical inspection where critical components are tested to ensure a safe race. Besides the mechanical inspection, the cars must pass the Noise and Brake Test to be allowed to enter a dynamic event. The Combustion Reunion will solely focus on dynamic events with Acceleration, Autocross, and Endurance. While the teams are granted four runs with two drivers in Acceleration and Autocross, Endurance only allows one run with two drivers. After the successful dynamic events on Friday and Saturday, the winner and the second and third place of Formula Student Combustion Reunion will receive their trophy during the Award Ceremony on Saturday. We cannot wait to see those cars on track, and we hope you do too!

Therefore, we proudly present a short profile of some of the vehicles which compete in this special event.

It should be noted that the following profiles are only a selection of the participating teams. A total of 20 alumni teams are taking part in the Reunion Cup.

Eine Hommage an 17 großartige Jahre Verbrenner bei der FSG

2023 ist ein besonderes Jahr für die FSG. Es ist nicht nur das 17. Mal, dass wir uns in Hockenheim treffen, zugleich ist es auch das letzte Jahr der Verbrennerklasse. Deshalb haben wir 24 Alumni-Teams eingeladen, an der FSG Combustion Reunion teilzunehmen. Wir freuen uns, Fahrzeuge begrüßen zu dürfen, die in den Jahren 2006 bis 2017 an einem Formula-Student-Wettbewerb teilgenommen haben. Die Teams, die sich jeweils aus fünf Alumni zusammensetzen, zeigen ihre Schönheiten und werden beweisen, dass ihre Autos vielleicht „alt" sind, aber mindestens noch genauso viele neue Emotionen wecken.

Wie bei jedem guten Oldtimer in Deutschland wird die Startnummer mit einem "H" registriert, um unsere besonderen Teilnehmer eindeutig zu kennzeichnen.

Die Combustion Reunion beginnt offiziell am Donnerstag mit einer separaten technischen Abnahme, bei der die wichtigsten Komponenten getestet werden, um ein sicheres Rennen zu gewährleisten. Neben der mechanischen Inspektion müssen die Autos auch den Noise Test und den Brake Test bestehen, um zu den dynamischen Disziplinen zugelassen zu werden. Die Combustion Reunion fokussiert sich ausschließlich auf den dynamischen Teil des Wettbewerbs mit Acceleration, Autocross und Endurance. Während die Teams bei Acceleration und Autocross insgesamt vier Läufe mit zwei Fahrern absolvieren dürfen, ist beim Endurance nur ein Lauf mit zwei Fahrern erlaubt. Nach den erfolgreichen dynamischen Events am Freitag und Samstag werden der Sieger sowie die Zweit- und Drittplatzierten der Formula Student Combustion Reunion bei der Siegerehrung am Samstag ihre Trophäe erhalten. Wir können es kaum erwarten, diese Autos auf der Strecke zu sehen, und wir hoffen, Sie auch!

Um die Vorfreude etwas steigen zu lassen, haben wir ein kurzes Profil einiger Fahrzeuge, die an diesem besonderen Event teilnehmen.

Es ist zu beachten, dass die folgenden Profile nur eine Auswahl der teilnehmenden Teams sind.

2008

CAR NAME
URE04 evo2 Mark III C-Spec

WEIGHT *(kg)*
Sufficient

DIMENSION *(L X W X H) in mm*
2200 x 1500 x 1100

UNIVERSITY RACING EINDHOVEN

SPECIAL MOMENTS OF THE CAR
(victories, crashes, fun moments)
Multiple oldtimer award winner @ZMF, Racetech Classic Cup and Eindhoven Open

COMPETITIONS
20+ events (official and alumni events)

CHANGES OR ADJUSTMENTS TO THE CAR
The question is rather "what hasn't changed"? But it still runs with the certified restrictor.

2011

CAR NAME
FAUmax delta

WEIGHT *(kg)*
157

DIMENSION *(L x W x H) in mm*
2570 x 1400 x 1010

HIGH-OCTANE MOTORSPORTS E.V.

SPECIAL MOMENTS OF THE CAR
(victories, crashes, fun moments)
FSA 2011: Skid Pad 1st, Design Event 1st, Autocross 3rd, Endurance 2nd, Fuel Efficiency 3rd, Overall 2nd;
FSG 2011: AUDI Best Lightweight Concept Award, TOGNUM Most Innovative Powertrain Award;
FSH 2011: Acceleration 3rd, Skid Pad 2nd, Fuel Efficiency 1st

COMPETITIONS
2011: FSA, FSG, FSH
2012: FSAE Michigan

FSUPV TEAM

COMPETITIONS
FSN 2017 (1st), FSG 2017 (25th), FSS 2017 (8th), FSAE Michigan 2018 (3rd)

CHANGES OR ADJUSTMENTS TO THE CAR
The FSUPV-04 had a complete revisit to its concept after the 2017 Summer competitions stint, when our team decided to embark in one of its riskiest but most memorable challenges so far: crossing the Atlantic Ocean to take part in one of the most emblematic FS competitions - FSAE Michigan. The car saw a major change in suspension changing from 10" to 13" rims, a concept we've stuck with ever since. Throughout the years, this car has served for concept developments, since it has the capability to mount 10 or 13 in wheels. Last but not least, since this year marks the 10th anniversary of the FSUPV Team, we'll also be remastering the FSUPV-04 original livery to keep the essence of our contender while embracing the progress made by our team along its 10 years of history.

SPECIAL MOMENTS OF THE CAR
(victories, crashes, fun moments)

"The reason behind our car choice to take part in the FSG Reunion is the FSUPV-04 marking a before and after in the history of our team. During the in-season competitions, we claimed our first Event Win after two back-to-back wins in Autocross and Endurance in the new-born FS Netherlands.

However, after a bittersweet end to the European competitions we decided to buckle-up and carry out an entire suspension and rim size change to the car, serving as a prototype test for its successor - the FSUPV-05. At the same time the decision was made to attend our only non-European competition to date: FSAE Michigan. This gamble did pay for itself, with the high-speed cornering superiority of our concept seeing us claim a 1st place in Endurance and an Overall 3rd place.

This experience was not only a track performance success, but built the foundations and momentum for the FSUPV-05 season and onwards, leaving a strong mark in our team's history."

CAR NAME
FSUPV-04

CAR'S NICKNAME
Elvis Tek

WEIGHT *(kg)*
218

DIMENSION *(L x W x H) in mm*
3075 x 1408 x 1195

2017

TUFAST RACING TEAM

SPECIAL MOMENTS OF THE CAR
(victories, crashes, fun moments)
2nd Place Overall FSAE Michigan

COMPETITIONS
FSUK, FSG, FSA, FSAE Michigan

2013

CAR NAME
nb013

CAR'S NICKNAME
Der Haufen

WEIGHT *(kg)*
188

DIMENSION *(L x W x H) in mm*
3084 x 1390 x 1459

2007

CAR NAME
MF one

CAR'S NICKNAME
1er

WEIGHT *(kg)*
270

DIMENSION *(L x W x H) in mm*
3150x1300x1200

MAINFRANKEN RACING E.V.

(Alumni-Team: Maindrunken Racing)

COMPETITIONS
FSG 2007

CHANGES OR ADJUSTMENTS TO THE CAR
Reworked Shifting System, Reworked Cooling System, Reworked Fuel System

RUB MOTORSPORT E.V.

2014

CAR NAME
RUB14

WEIGHT *(kg)*
218

DIMENSION *(L x W x H) in mm*
2780 x 1400 x 1200

SPECIAL MOMENTS OF THE CAR
(victories, crashes, fun moments)
FSG-Hockenheim and FS-ATA

COMPETITIONS
FSG, FS-ATA, FS-Czech

ALUMNICS REGENSBURG E. V.

2017

CAR NAME
RP17c

WEIGHT *(kg)*
206,5

DIMENSION *(L x W x H) in mm*
3005 x 1410 x 1194

SPECIAL MOMENTS OF THE CAR
(victories, crashes, fun moments)
1st place Wetpad@FSG,
1st place Business Plan @FSS

COMPETITIONS
FSA, FSG, FSS

HAWKS SENIORCREW

COMPETITIONS
FSA, FSH, FSG, FS-ATA, FSAE Michigan

CHANGES OR ADJUSTMENTS TO THE CAR
Ride hide adjustment for different Tire Dimensions / mech. suspension change

CAR NAME
H09

WEIGHT *(kg)*
205

DIMENSION *(L x W x H) in mm*
3224 x 1397 x 1071

2013

SPECIAL MOMENTS OF THE CAR
(victories, crashes, fun moments)

"Overall quite a successful car, also the first Hawks car with ABS and our first overseas competitor (Michigan 2014). She is by far our most reliable racer and very fast as well. We love to tell the story about our Autocross Win in FS Italy 2013.

It's been raining the whole day and even though our starter failed shortly before the end of the autocross slot, we managed to get the fastest time in with aquaplaning on the track. She also was faster than most of the Electric vehicles in the FS Austria Endurance and took overall third place in Hungary.

It doesn't matter, what issue turns up, our H09 will always find a way to be the fastest car on track."

HIGHSPEED KARLSRUHE

- SPECIAL MOMENTS OF THE CAR
  (victories, crashes, fun moments)
  1st place engineering design FS-ATA 13, 3rd Place Skid-Pad FSG 13, caught fire during ZF Race Camp 13
- COMPETITIONS
  FSG, FS-ATA, FSS
- CHANGES OR ADJUSTMENTS TO THE CAR
  Stock

CAR NAME
F-107

CAR'S NICKNAME
Laura

WEIGHT *(kg)*
206

DIMENSION *(L x W x H) in mm*
2700 x 1400 x 1200

2013

2015

DEEFHOLT DYNAMICS

CAR NAME
DD15

CAR'S NICKNAME
Liviana

WEIGHT *(kg)*
212

DIMENSION *(L x W x H) in mm*
2756 x 1500 x 1244

- SPECIAL MOMENTS OF THE CAR
  (victories, crashes, fun moments)
  Speed record in reverse driving
- COMPETITIONS
  FSG, FSA
- CHANGES OR ADJUSTMENTS TO THE CAR
  New tires

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Awards 2023

Results:

https://fsg.one/results

	Formula Student	Combustion	Electric	Driverless	Reunion CUP
OVERALL	1st Place Overall	SUN	SUN	SUN	SUN
	2nd Place Overall	SUN	SUN	SUN	SUN
	3rd Place Overall	SUN	SUN	SUN	SUN
DYNAMICS	Acceleration Winner	SAT	SAT	–	
	Autocross Winner	SUN	SUN	–	
	Endurance Winner	SUN	SUN	–	
	Skid Pad Winner	SAT	SAT	–	
	Most Fuel/Energy Efficient Car	SUN	SUN	–	
	DV Acceleration	SAT	SAT	–	
	DV Skid Pad	SAT	SAT	–	
	DV Autocross	–	–	SUN	
	Trackdrive	–	–	SUN	
STATICS	Business	SAT	SAT	–	
	Cost	SAT	SAT	–	
	Design	SAT	SAT	SAT	
SPECIAL AWARDS	FSG Siemens Digital Twin Engineering Excellence Award		SAT		

STATUS/STAND: 24.07.2023

Schedule 2023

https://today.formulastudent.de

Mon, 7th of August

13:00	C E	Technical Inspection-, Registration- & Entrance Order Available	V	Website

Mon, 14th of August

08:00 - 08:30	E	Registration + Entrance for 30 Teams (7 Members)	11+8	South Stand, Pits
08:00 - 23:59	E	Pits available	8	Pits
09:30 - 10:00	E	Registration + Entrance for 10 Teams (7 Members)	11+8	South Stand, Pits
10:00 - 20:00	E	Technical Inspections (A, D, E, M & P)	2+3	Charging Tent, Dynamic Area
10:00 - 22:00	E	Charging Tent available	2	Charging Tent
12:00 - 12:30	E	Registration + Entrance for 30 Teams (7 Members)	11+8	South Stand, Pits

Tue, 15th of August

07:00 - 22:00	E	Charging Tent available	2	Charging Tent
07:00 - 23:59	E	Pits available	8	Pits
07:45 - 12:30	E	Event Control	5	Event Control
09:00 - 13:00	E	Technical Inspections (A, D, E, M & P)	2+3	Charging Tent, Dynamic Area
09:00 - 19:00	C E	Emergency Brake System (EBS) Test *	12	Start/Finish Line
13:00 - 19:00	C E	Engine Test *	3	Dynamic Area
13:00 - 19:00	C E	Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake	2+3	Charging Tent, Dynamic Area
14:00 - 19:00	C E	Event Control	5	Event Control
15:00 - 17:30	C	Registration for 30 CV Teams	14	Ticket Centre
15:30 - 19:00	C	Entrance for 30 CV Team Vehicles + All Members	0	Venue
15:30 - 23:59	C E	Pits & Recreation Area available	8+10	Pits, Recreation Tent
21:00 - 22:00	C E	Team Welcome	7	Marquee Above Pits

Wed, 16th of August

06:00 - 22:00	E	Charging Tent available	2	Charging Tent
06:00 - 23:59	C E	Pits & Recreation Area available	8+10	Pits, Recreation Tent
07:45 - 18:00	C E	Ticket Centre	14	Ticket Centre
08:00 - 13:00	C E	Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake	2+3	Charging Tent, Dynamic Area
08:00 - 18:00	C E	Welding Station	8	Welding Station
08:30 - 12:30	C E	Event Control	5	Event Control
09:00 - 18:00	C E	FSG Academy On Site	11	South Stand
09:00 - 18:00	C E	Emergency Brake System (EBS) Test *	12	Start/Finish Line
09:00 - 19:00	C E	Engine Test	3	Dynamic Area
10:10 - 18:05	E	Business Plan Presentation	1+9	BW Tower, Ravenol Tower
10:15 - 16:15	C	Engineering Design	7	Marquee Above Pits
10:15 - 17:10	C E	Cost Analysis	7	Marquee Above Pits
13:00 - 18:30	E	Practice Track DV + MV	3	Dynamic Area
13:00 - 20:00	C E	Team Photos	7	Marquee Above Pits
14:00 - 19:00	C E	Event Control	5	Event Control
14:00 - 19:00	C E	Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake	2+3	Charging Tent, Dynamic Area

Thu, 17th of August

06:00 - 18:30	C E	Recreation Area available	10	Recreation Tent
06:00 - 22:00	E	Charging Tent available	2	Charging Tent
06:00 - 23:59	C E	Pits available	8	Pits
07:45 - 18:00	C E	Ticket Centre	14	Ticket Centre
08:00 - 18:00	C E	Welding Station	8	Welding Station
08:30 - 12:30	C E	Event Control	5	Event Control
08:00 - 13:00	C E	Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake	2+3	Charging Tent, Dynamic Area
08:30 - 18:30	C E	Practice Track DV + MV	3	Dynamic Area - A
08:30 - 18:30	C E	Practice Track DV + MV	13	Test Area - B
08:40 - 15:30	C	Business Plan Presentation	1+9	BW Tower, Ravenol Tower
08:45 - 15:55	E	Cost Analysis, Engineering Design	7	Marquee Above Pits
09:00 - 12:00	C E	Emergency Brake System (EBS) Test *	12	Start/Finish Line
09:00 - 18:00	C E	FSG Academy On Site	11	South Stand
09:00 - 19:00	C E	Engine Test	3	Dynamic Area
09:30 - 16:15	E	Business Plan Presentation	1+9	BW Tower, Ravenol Tower
11:15 - 17:30	E	Team Photos	7	Marquee Above Pits
13:00 - 19:00	C E	Emergency Brake System (EBS) Test *	12	Start/Finish Line
14:00 - 19:00	C E	Event Control	5	Event Control
14:00 - 19:00	C E	Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake	2+3	Charging Tent, Dynamic Area
15:00 - 19:00	C E	Driverless Skidpad	3	Dynamic Area - B
17:30 - 19:00	C E	Business Plan Presentation Finals	7	Marquee Above Pits
19:00 - 21:00	C	Engineering Design Finals (not public)	6	FSG Forum

Fr, 18th of August

06:00 - 22:00	E	Charging Tent available	2	Charging Tent
06:00 - 23:59	C E	Pits & Recreation Area available	8+10	Pits, Recreation Tent
07:30 - 12:30	C E	Event Control	5	Event Control
07:45 - 18:00	C E	Ticket Centre	14	Ticket Centre
08:00 - 18:00	C E	Welding Station	8	Welding Station
08:30 - 11:30	C E	Manual Skidpad	3	Dynamic Area - B
08:30 - 12:00	C E	Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake *	2+3	Charging Tent, Dynamic Area
08:30 - 18:30	C E	Engine Test	3	Dynamic Area
08:30 - 18:30	C E	Practice Track DV	13	Test Area - B
08:30 - 18:30	C E	Practice Track MV	3	Dynamic Area - A
09:00 - 10:00	C E	Design Review	7	Marquee Above Pits
09:00 - 11:50	C E	Cost Finals	1	BW Tower 4th floor
09:00 - 17:00	C E	Emergency Brake System (EBS) Test *	3	Dynamic Area
09:00 - 18:00	C E	FSG Academy On Site	11	South Stand
09:30 - 12:30	C E	Driverless Acceleration	12	Start/Finish Line
10:00 - 12:00	C E	Design Feedback: Judges available	7	Marquee Above Pits
12:00 - 12:45		Press Guided Tour	1	Assembly at entrance BW Tower
13:00 - 18:00	C E	Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake *	2+3	Charging Tent, Dynamic Area
13:30 - 14:30	C E	VIP & Press Reception	1	BW Tower 5th floor
13:30 - 16:30	C E	Manual Acceleration	12	Start/Finish Line
14:00 - 19:00	C E	Event Control	5	Event Control
15:00 - 15:25	C E	Driverless Autocross Course Walk	3	Dynamic Area - B
15:30 - 18:30	C E	Driverless Autocross	3	Dynamic Area - B
16:45 - 18:00	H	Historic Acceleration	12	Start/Finish Line
19:00 - 22:00	E	Engineering Design Finals (not public)	6	FSG Forum

Sat, 19h of August

06:00 - 22:00	E	Charging Tent available	2	Charging Tent
06:00 - 23:59	C E	Pits available	8	Pits
07:30 - 12:30	C E	Event Control	5	Event Control
07:45 - 18:00	C E	Ticket Centre	14	Ticket Centre
08:00 - 11:00	C E	Driverless Trackdrive	3	Dynamic Area - B
08:00 - 18:00	C E	Welding Station	8	Welding Station
08:30 - 18:30	C E	Practice Track DV + MV	13	Test Area - A
08:30 - 18:30	C E	Technical Inspections (A, D, E, M & P), Tilt, Rain, Noise, Brake [on request]	2+3	Charging Tent, Dynamic Area
08:30 - 19:00	C E	Engine Test	3	Dynamic Area
10:45 - 11:15	C E	Staging of Cars for Panoramic Picture	3	Dynamic Area
11:00 - 13:00		Worldwide Formula Student Officials Meeting	1	BW Tower 4th floor
11:15 - 11:45	C E	Staging of Team Members for Panoramic Picture	3	Dynamic Area
12:15 - 12:40	C E	Autocross Course Walk	3	Dynamic Area
12:45 - 14:00	H	Historic Autocross	3	Dynamic Area
14:00 - 19:00	C E	Event Control	5	Event Control
14:00 - 19:00	C E	Manual Autocross	3	Dynamic Area
19:00 - 20:00	C E	Free Food powered by VW Group	0	Venue
21:00 - 22:30	C E	Awards Ceremony - Part I	7	Marquee Above Pits

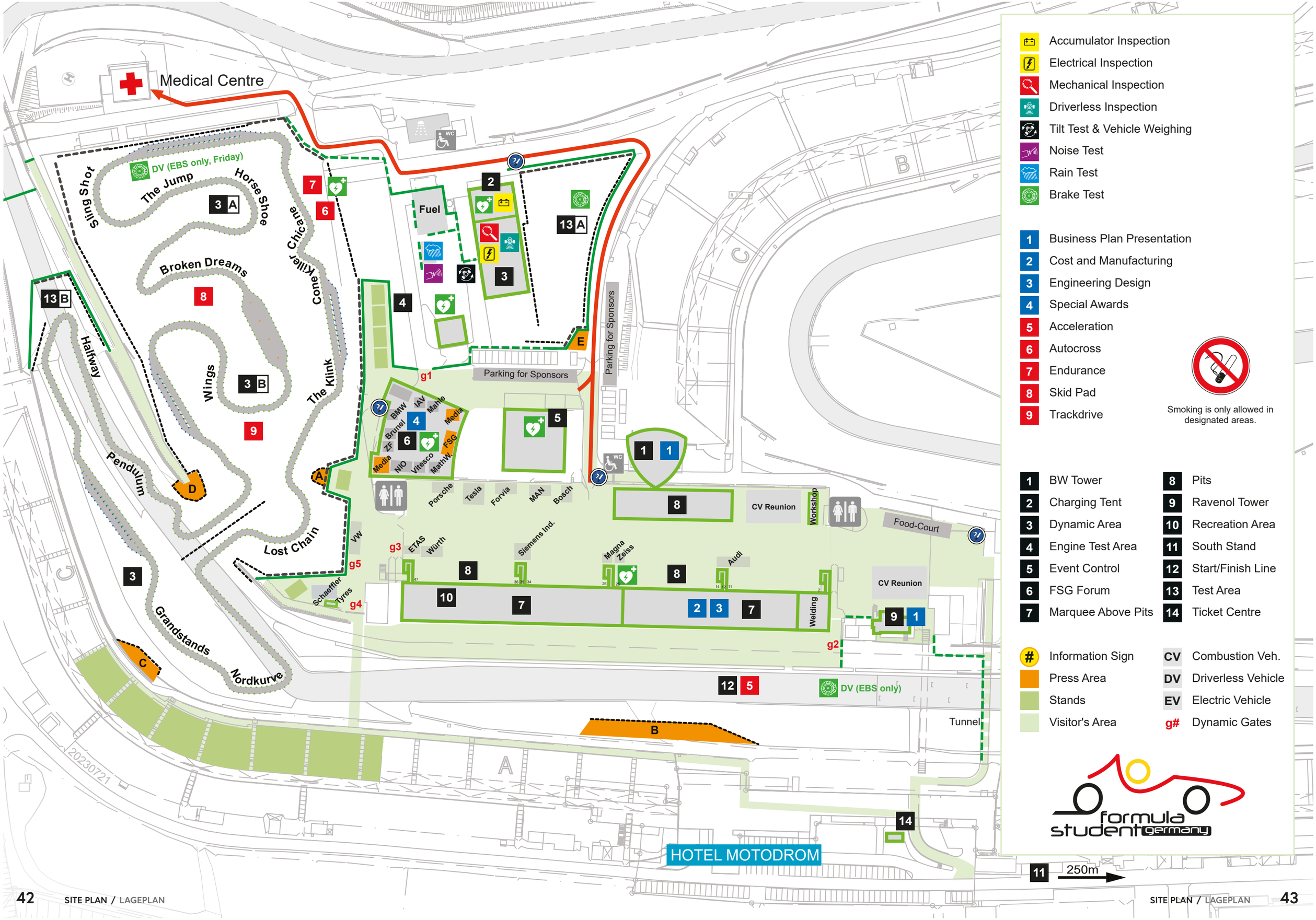
Sun, 20th of August

06:00 - 15:00	C E	Recreation Area available	10	Recreation Tent
06:00 - 19:00	E	Charging Tent available	2	Charging Tent
06:00 - 19:00	C E	Pits available	8	Pits
07:30 - 12:30	C E	Event Control	5	Event Control
07:45 - 16:00	C E	Ticket Centre	14	Ticket Centre
08:00 - 08:25	C E	Endurance Course Walk	3	Dynamic Area
08:00 - 18:00	C E	Welding Station	8	Welding Station
08:30 - 12:00	C E	Practice Track DV + MV	13	Test Area - A
08:30 - 16:30	C E	Engine Test	3	Dynamic Area
08:30 - 17:00	C E	Endurance	3	Dynamic Area
12:00 - 19:00	C E	Dismantling of Pits	8	Pits
14:00 - 19:00	C E	Event Control	5	Event Control
20:00 - 21:00	C E	Awards Ceremony - Part II	7	Marquee Above Pits
21:00 - 23:59	C E	MAHLE-Party	7	Marquee Above Pits

Abbreviations
CV - Internal Combustion Engine Vehicle, DV - Driverless Vehicle, EV - Electric Vehicle, MV – Manual driven Vehicle
Technical Inspections (A, D, E, M & P): Accumulator-, Driverless-, Electrical- Mechanical- & Pre-Inspection

* on request

STATUS/STAND: **11.07.2023**


Medical Centre
DV (EBS only, Friday)
The Jump
Horse Shoe
Sling Shot
Chicane
Killer
Broken Dreams
Halfway
Wings
The Klink
Pendulum
Lost Chain
Grandstands
Nordkurve
Fuel
Parking for Sponsors
Parking for Sponsors
g1
BMW
IAV
Mahle
Media
Brunel
ZF
FSG
Media
NIO
Vitesco
MathW.
Porsche
Tesla
Forvia
MAN
Bosch
CV Reunion
Workshop
Food-Court
g3
ETAS
Würth
Siemens Ind.
Magna
Zeiss
Audi
CV Reunion
VW
g5
Schaeffler
Tyres
g4
Welding
g2
DV (EBS only)
Tunnel
B
HOTEL MOTODROM
20230721
250m
Accumulator Inspection
Electrical Inspection
Mechanical Inspection
Driverless Inspection
Tilt Test & Vehicle Weighing
Noise Test
Rain Test
Brake Test
1 Business Plan Presentation
2 Cost and Manufacturing
3 Engineering Design
4 Special Awards
5 Acceleration
6 Autocross
7 Endurance
8 Skid Pad
9 Trackdrive
Smoking is only allowed in designated areas.
1 BW Tower
2 Charging Tent
3 Dynamic Area
4 Engine Test Area
5 Event Control
6 FSG Forum
7 Marquee Above Pits
8 Pits
9 Ravenol Tower
10 Recreation Area
11 South Stand
12 Start/Finish Line
13 Test Area
14 Ticket Centre
Information Sign
Press Area
Stands
Visitor's Area
CV Combustion Veh.
DV Driverless Vehicle
EV Electric Vehicle
g# Dynamic Gates
formula student germany

Guided Tours

Time schedule /
Führungszeiten
Guided Tours
https://fsg.one/gtours

Exploring the Formula Student Germany with guided tours

We would like to invite you to make the most of your visit at the Formula Student Germany. Therefore we have prepared different tours for visitors, press and sponsors. 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. These tours at the competition site will follow the yellow path you can see at the map.

Exploring on your own

The roman numerals mark the most important spots you can discover at the event site. Following them in order will take you from the dynamic area to the technical inspection and then on to the pit lane. Along the way there are different big signs placed. You will learn about the history of the competition as well as the different competitions running in parallel (Combustion, Electric and Driverless Cup). Don't be shy to ask team members anything you would like to know about their car. However, remember they are participating in a competition, so make sure not to hinder them, please. From the pit lane, the tour takes you back to the large dynamic area. The tour will finish back at the FSG Forum, where you all the students, sponsors, press representatives and visitors come together.

Entdecken Sie die Formula Student Germany mit geführten Touren

Wir möchte Sie einladen, das Beste aus Ihrem Besuch bei der Formula Student Germany zu machen. Dafür haben wir verschiedene Touren für Besucher, Presse oder Sponsoren vorbereitet. Wenn Sie sich für eine Führung anmelden möchten, wenden Sie sich bitte an den Counter im FSG Forum. Dort bekommen Sie weiterführende Informationen über unser Angebot. Diese Touren über das Wettbewerbsgelände folgen dem gelben Weg, der auf der Karte erkennbar ist.

Erkundung auf eigene Faust

Die römischen Ziffern markieren die wichtigsten Punkte, die Sie auf dem Eventgelände entdecken können. Wenn Sie ihnen folgen, gelangen Sie vom dynamischen Bereich zur technischen Inspektion und dann weiter in die Boxengasse. Auf dem Weg dorthin sind verschiedene große Schilder angebracht. Sie erfahren etwas über die Geschichte des Wettbewerbs sowie über die verschiedenen parallel laufenden Wettbewerbe (Combustion, Electric und Driverless Cup). Scheuen Sie sich nicht, die Teammitglieder alles zu fragen, was Sie über ihr Auto wissen möchten. Denken Sie aber daran, dass sie an einem Wettbewerb teilnehmen, also behindern Sie sie bitte nicht. Von der Boxengasse aus führt die Tour zurück in den großen dynamischen Bereich. Die Tour endet wieder im FSG-Forum, wo alle Studierenden, Sponsoren, Pressevertreter und Besucher zusammen kommen.

I

Dynamic Area

The racetrack is the heart of the event site. Here, the majority of the the dynamic event disciplines take place.

Die Rennstrecke ist das Herzstück des Veranstaltungsgeländes. Hier finden die meisten der dynamischen Wettbewerbsdisziplinen statt.

II

FSG Forum

With its visitor counter, press area, VIP reception and sponsor booths, the FSG forum is the main meeting point of the event site.

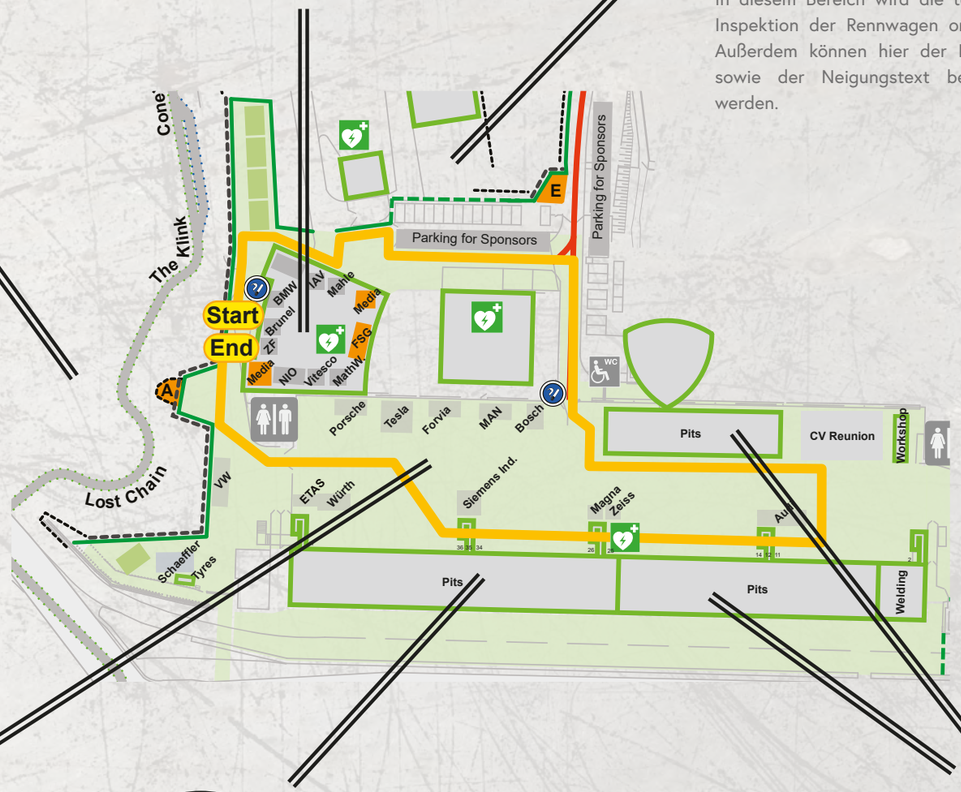
Mit dem Besuchercounter, Pressebereich, VIP-Empfang und Sponsorenständen ist das FSG Forum der Haupttreffpunkt des Veranstaltungsgeländes.

III

Technical Inspection

In this area the technical inspection of the race cars is organized. Furthermore the brake test as well as the tilt text can be spotted here.

In diesem Bereich wird die technische Inspektion der Rennwagen organisiert. Außerdem können hier der Bremstest sowie der Neigungstext beobachtet werden.



VI

Booths of the FSG partners

Thanks to our partners, we are able to organize this event every year. You are welcome to visit the different booths and discover the activities they are offering.

Dank unserer Partner sind wir in der Lage, diese Veranstaltung jedes Jahr zu organisieren. Sie sind herzlich eingeladen, die verschiedenen Partner zu besuchen und die angebotenen Aktivitäten zu entdecken.

V

Marquee above the pits

The area above the pits is used for the static disciplines Engineering Desing Report and Cost Manufacturing Event as well as the evening ceremonies and the famous Mahle party.

Der Bereich oberhalb der Pits wird für die statischen Disziplinen Engineering Desing Report und Cost Manufacturing Event genutzt sowie für die abendlichen Shows und die berühmte Mahle-Party.

IV

Team pits

Each of the participating teams has its own pit, either in the big tent or in the original Formula 1 pit lane.

Jedes der teilnehmenden Teams hat seine eigene Box, entweder im großen Zelt oder in der originalen Formel-1-Boxengasse.

Interview with Naz Aydemir
Business Development Consultant
Siemens Digital Industries Software

Paving the way for FS Teams in the Software Space

Wegbereiter für FS-Teams im Softwarebereich

Written by Catharina Schiffter

How Siemens Digital Industries Software supports Formula Student

The automotive industry is in the midst of a digital revolution, where state-of-the-art engineering software and digital twins play a pivotal role in vehicle design, performance optimization, and safety enhancement. Formula Student teams recognize the importance of engineering software in this landscape and have started integrating digital twins into their projects for a competitive advantage. To leverage the immense potential of software solutions, teams partner with industry leaders like Siemens Digital Industries Software, who provide cutting-edge tools, technical expertise, and support to develop efficient and innovative mechatronic and software systems.

Naz Aydemir, Business Development Consultant, explains why Siemens Digital Industries Software is deeply involved in the Engineering Design competitions and what the Siemens Digital Twin Award is all about.

Wie Siemens Digital Industries Software die Formula Student unterstützt

Die Automobilindustrie befindet sich mitten in einer digitalen Revolution, in der Software eine zentrale Rolle bei der Fahrzeugkonstruktion, der Leistungsoptimierung und der Verbesserung der Sicherheit spielt. Die Formula Student-Teams haben die Bedeutung von Software in diesem Umfeld erkannt und sind dazu übergegangen, Digital Twins in ihre Projekte zu integrieren, um einen Wettbewerbsvorteil zu erzielen. Um das immense Potenzial von Softwarelösungen zu nutzen, arbeiten die Teams mit Branchenführern wie Siemens Digital Industries Software zusammen, die hochmoderne Tools, technisches Know-how und Support für die Entwicklung effizienter und innovativer mechatronischer und Softwaresysteme bereitstellen.

Naz Aydemir, Business Development Consultant, erklärt, warum sich Siemens Digital Industries Software so stark an den Engineering Design Wettbewerben beteiligt und was es mit dem Siemens Digital Twin Award auf sich hat.

Es ist eine fantastische Zusammenarbeit, die alle Beteiligten bereichert und uns hilft, neue und unkonventionelle Wege für den Einsatz unserer Software zu finden.

It's a win-win situation: teams get to dive deep into our software, gaining valuable expertise, while we get to tap into their application know-how.

Your support of Formula Student is quite extensive. Why is Siemens Digital Industries Software engaging so heavily in FSG?

At Siemens, we genuinely appreciate the value that young talents bring to our organization. We created an environment that promotes knowledge exchange. It's a win-win situation: teams get to dive deep into our software, gaining valuable expertise, while we get to tap into their application know-how. It's a fantastic collaboration that enriches everyone involved and helps us uncover new and unconventional ways to use our software.

The so-called "Formula Student Community" at Siemens is a cross-departmental collaboration platform focusing on technical exchange with the teams and fostering the FS spirit in our organization.

Another great activity last year was that we exhibited with a Formula Student team at the Hannover Messe (HMI) how they developed their unique solution with our Siemens software. This was real proof of how closely we work with the teams now! This allowed us to demonstrate the potential of our software using Formula Student as an example.

That sounds great! How can teams get involved? How many teams do you support currently?

We currently have more than 80 teams using Siemens software. That's many teams putting their trust in us! Our approach to combining technical expertise, consulting, and education is truly unique.

For example, we have set up a Teams channel for FS teams to contact us with special requests on new applications. It's like having a direct line to our Technical Sales team, so they can get the assistance they need quickly. We also have working students ready to jump in and help with any specific problem they might encounter. We want to make sure teams feel supported every step of the way.

Another highlight of our collaboration with teams is the annual Bootcamp we organize during the planning phase. It is a complete training program, for example, on our NX Software, led by our pre-sales and support team. This hands-on seminar gives teams a deep dive into the software and equips them with practical skills they can apply directly to their projects. It's all about giving them the knowledge and tools they need to excel.

Ihr Engagement für die Formula Student ist sehr umfangreich. Warum engagiert sich Siemens Digital Industries Software so stark für die FSG?

Bei Siemens schätzen wir den Wert, den junge Talente für unser Unternehmen haben. Wir haben ein Umfeld geschaffen, das den Wissensaustausch fördert. Es ist eine Win-Win-Situation: Die Teams tauchen tief in unsere Software ein und gewinnen wertvolles Fachwissen, während wir von ihrem Anwendungs-Know-how profitieren. Es ist eine fantastische Zusammenarbeit, die alle Beteiligten bereichert und uns hilft, neue und unkonventionelle Wege für den Einsatz unserer Software zu finden.

Die sogenannte „Formula Student Community" bei Siemens ist eine abteilungsübergreifende Kooperationsplattform, die sich auf den technischen Austausch mit den Teams und die Förderung des FS-Geistes in unserer Organisation konzentriert.

Eine weitere tolle Aktion im letzten Jahr war, dass wir gemeinsam mit einem Formula Student Team auf der Hannover Messe (HMI) ausgestellt haben, wie sie ihre einzigartige Lösung mit unserer Siemens Software entwickelt haben. Das war ein echter Beweis wie eng wir mit den Teams mittlerweile zusammenarbeiten! Damit konnten wir das Potenzial unserer Software am Beispiel Formula Student unter Beweis stellen.

Das klingt großartig! Wie können sich Teams beteiligen? Wie viele Teams unterstützen Sie derzeit?

Wir haben derzeit 75 Teams, die Siemens-Software verwenden. Das sind echt viele Teams, mit denen wir zusammenarbeiten. Unser Ansatz, das technisches Know-how mit die Beratung und Weiterbildung zu kombinieren, ist wirklich einzigartig.

Wir haben zum Beispiel einen Teams-Kanal eingerichtet, über den sich FS-Teams mit speziellen Anfragen zu neuen Anwendungen an uns wenden können. Das ist wie ein direkter Draht zu unserem technischen Vertriebsteam, so dass sie schnell die benötigte Unterstützung erhalten können. Wir haben auch WerkStudierenden, die bereit sind, bei jedem spezifischen Problem zu helfen, auf das sie stoßen könnten. Wir möchten sicherstellen, dass sich die Teams in jeder Phase des Prozesses unterstützt fühlen.

Ein weiterer Höhepunkt unserer Zusammenarbeit mit den Teams ist das jährliche Bootcamp, das wir während der Planungsphase organisieren. Dabei handelt es sich um ein konzentriertes Schulungsprogramm, z. B. zu unserer NX-Software, das von unserem Pre-Sales- und Support-Team geleitet wird. Dieses praxisorientierte Seminar bietet den Teams einen tiefen Einblick in die Software und vermittelt ihnen praktische Fähigkeiten, die sie direkt in ihren Projekten anwenden können. Es geht darum, ihnen das Wissen und die Werkzeuge zu vermitteln, die sie brauchen, um erfolgreich zu sein.

Another initiative I associate with Siemens Digital Industries Software is the “Siemens Digital Twin Award”. Can you tell us more about that?

Digitalization in the Formula Student world has come a long way since 2015. Teams have elevated their work and collaboration, and we introduced the "Siemens Digital Twin Award" to accelerate their journey. This award recognizes how teams structure their work, exchange knowledge, and share their vision, regardless of technical level. Our judging process involves technical experts who evaluate teams in categories like design, simulation, data management, and innovation.

We value improvement over the years. With the award, we support teams in embracing digitalization, focusing on technical accomplishments, collaboration, and pushing boundaries. We're proud to be part of the FS community's digitalization journey. Witnessing teams harness the power of digital transformation and elevate their projects is truly unique.

Eine weitere Initiative, die ich mit Siemens Digital Industries Software verbinde, ist der „Siemens Digital Twin Award“. Kannst du uns mehr darüber erzählen?

Die Digitalisierung in der Formula Student Welt hat seit 2015 einen langen Weg zurückgelegt. Die Teams haben ihre Arbeit und Zusammenarbeit verbessert, und wir haben den „Siemens Digital Twin Award" eingeführt, um diese Entwicklung zu beschleunigen. Dieser Preis würdigt die Art und Weise, wie Teams ihre Arbeit strukturieren, Wissen austauschen und ihre Visionen teilen, unabhängig vom technischen Niveau. An unserem Bewertungsverfahren sind technische Experten beteiligt, die die Teams in Kategorien wie Design, Simulation, Datenmanagement und Innovation bewerten.

Wir legen Wert auf Verbesserungen im Laufe der Jahre. Mit dem Preis unterstützen wir Teams dabei, die Digitalisierung voranzutreiben, sich auf technische Errungenschaften zu konzentrieren, zusammenzuarbeiten und Grenzen zu verschieben. Wir sind stolz darauf, Teil der Digitalisierungsreise der FS-Community zu sein. Zu sehen, wie Teams die Kraft der digitalen Transformation nutzen und ihre Projekte voranbringen, ist wirklich einzigartig.

One last question: How can teams participate that just get started?

There are several ways for the younger teams to get ahead in the Formula Student journey. Teams can approach us for software sponsoring in order to make use of Siemens Digital Industries Software's large portfolio of engineering tools. Moreover, the Siemens Digital Twin Award is open to beginner teams. It's not solely based on the current technical implementation but also values the vision and steps taken to achieve it.

Eine letzte Frage: Wie können Teams teilnehmen, die gerade erst mit FS angefangen haben?

Es gibt mehrere Möglichkeiten für die jungen Teams, bei der Formula Student weiterzukommen. Die Teams können Software-Sponsoring in Anspruch nehmen, um das große Portfolio an Ingenieurs-Tools von Siemens Digital Industries Software zu nutzen. Außerdem steht der Siemens Digital Twin Award auch Einsteigerteams offen. Der Preis orientiert sich nicht nur an der technische Umsetzung, sondern bewertet auch die Vision und die Schritte zu ihrer Verwirklichung.

Teams can approach us for software sponsoring in order to make use of Siemens Digital Industries Software's large portfolio of engineering tools.

Die Teams können Software-Sponsoring in Anspruch nehmen, um das große Portfolio an Ingenieurs-Tools von Siemens Digital Industries Software zu nutzen.

Sponsoren Statements

Written by Jennifer Stratmann

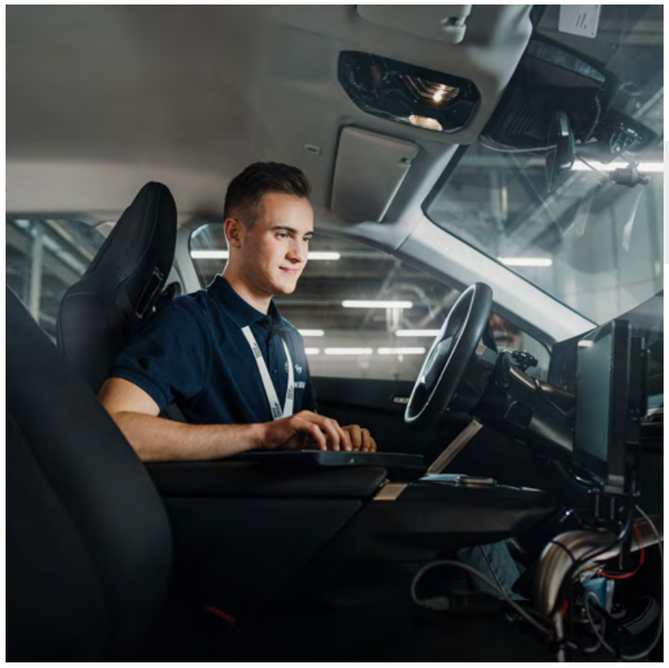
Formula Student Germany is an event that can take place every year thanks to the support of our numerous partners. This event format gives companies the chance to get in touch with young students, to support them in their studies in a practice-oriented way and to show them a successful career path. By establishing contact at an early stage, a sustainable network is created from which both sides benefit. In addition, there is the unique opportunity to exchange perspectives and thus learn from each other to jointly shape the mobility of tomorrow. We are convinced that this kind of cooperation will help to create a future in which the visions, know-how and strengths of all generations are united. With this in mind, we thank our partners for their years of support and trust in our Formula Student philosophy.

Die Formula Student Germany ist ein Event, dass aufgrund der Unterstützung unserer zahlreichen Partner jährlich ermöglicht werden kann. Dieses Veranstaltungsformat gibt den Unternehmen die Chance in Kontakt mit jungen Studierenden zu treten, sie in ihrem Studium praxisorientiert zu unterstützen und ihnen einen erfolgreichen Karriereweg aufzuzeigen. Durch eine frühe Kontaktaufnahme wird ein nachhaltiges Netzwerk geschaffen, von den beiden Seiten profitieren. Zudem besteht die einzigartige Möglichkeit Perspektiven auszutauschen und somit voneinander zu lernen, um gemeinsam die Automobilität von morgen zu gestalten. Wir sind überzeugt, dass diese Art der Zusammenarbeit dazu beiträgt eine Zukunft zu kreieren, in der die Visionen, das Know-How und die Stärken aller Generationen vereint sind. In diesem Sinne danken wir unseren Partnern für die jahrelange Unterstützung und das Vertrauen in unserer Formula Student Philosophie.

Christian Stark
Talent 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.

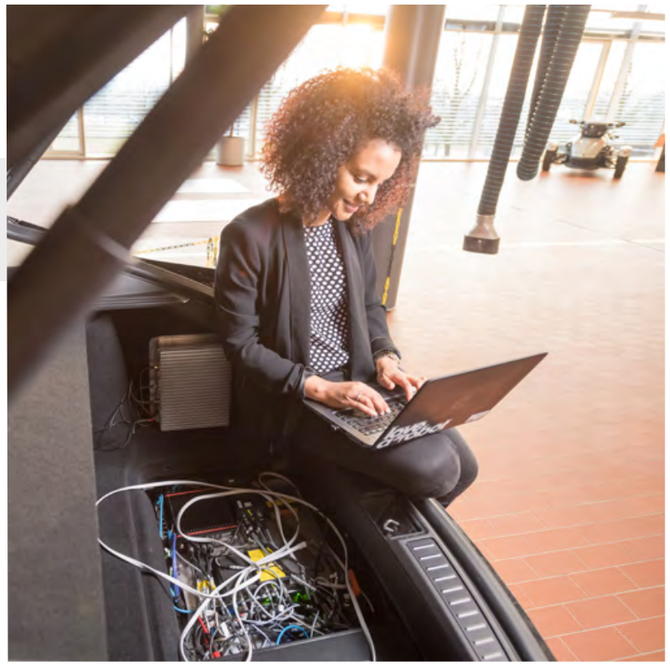


Oliver Ferschke
Head of HR Marketing BMW Group

Whether in R&D, IT or production, engineers play a pivotal role across the entire bandwidth of our operations. Without deep theoretical and practical know-how our visions for sustainable mobility would go nowhere. That is why we are always looking for tech-savvy students to apply their skills in highly agile and collaborative working environments.

Ob in F&E, IT oder Produktion, Ingenieure spielen bei der BMW Group eine zentrale Rolle. Nur mit fundiertem theoretischen und praktischen Know-How erreichen wir unsere Visionen für nachhaltige Mobilität. Deshalb sind wir immer auf der Suche nach technisch versierten Studenten, die ihre Fähigkeiten unter herausfordernden Arbeitsumgebungen anwenden.

BOSCH
Invented for life



Heidi Stock
Human Resources Management - Talent Acquisition

At Bosch, our vision is to transform our products into smart assistants for all humans by using artificial intelligence – as we do with autonomous driving. Behind this vision stand associates with individual competences, mindsets and experience – as diverse, as the teams of FSG. That's why we have supported FSG for many years.

Unsere Vision bei Bosch ist mit künstlicher Intelligenz unsere Produkte zu intelligenten Assistenten der Menschen zu machen. Wie beim autonomen Fahren. Dahinter stecken Mitarbeiter*innen mit individuellen Kompetenzen, Denkweisen und Erfahrungen – so vielfältig, wie die Teams der FSG, die wir jedes Jahr gerne unterstützen.

ETAS

Dr. Claudio Seitz
Head of Business Strategy and M&A

Team spirit, commitment, passion for technology & innovation - these are the qualities that ETAS and the Formula Student teams have in common. We are feverish with all our teams when they show what they can do with their engineering skills, their heart and soul under the toughest conditions. We wish all teams the success to be at the forefront.

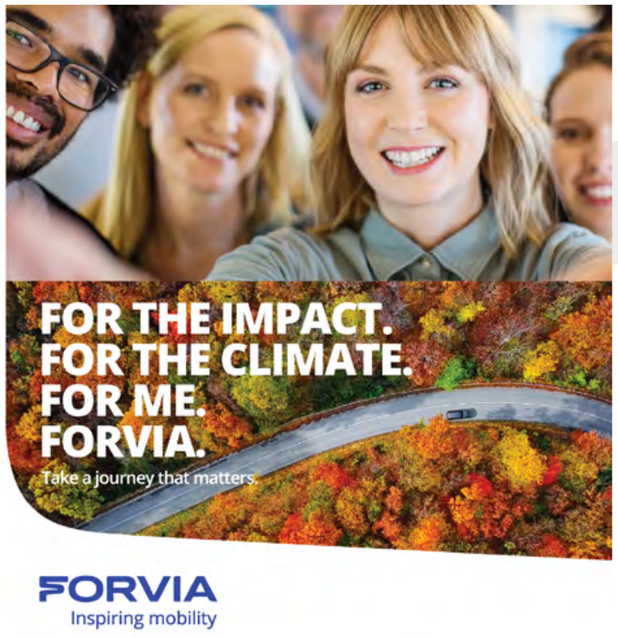
Teamspirit, Engagement, Leidenschaft für Technik & Innovation - das sind die Eigenschaften, die ETAS und die Formula Student-Teams verbinden. Wir fiebern mit allen unseren Teams, wenn sie mit Ingenieurskunst und Herzblut unter den härtesten Bedingungen zeigen, was sie können. Wir wünschen allen Teams den Erfolg, ganz vorne mit dabei zu sein.

Brunel

Markus Eckhardt
Managing Director DACH-CZ

Smart, autonomous, environmentally friendly: This is how we are shaping the future of mobility. For this, we need the talent, creativity and enthusiasm of FSG's budding engineers. Together, we share a passion for implementing forward-looking projects in engineering and IT. That is why Brunel has been supporting FSG since 2006.

Smart, autonom, umweltfreundlich: So gestalten wir die Zukunft der Mobilität. Hierfür benötigen wir das Talent, die Kreativität und Begeisterung der angehenden Ingenieur: innen der FSG. Gemeinsam teilen wir die Leidenschaft für die Umsetzung zukunftsweisender Projekte im Engineering & der IT. Deshalb unterstützt Brunel die FSG bereits seit 2006.



FORVIA
Inspiring mobility

Ina Raffin
Communication Manager Clean Mobility Europe Division & Project Manager FSG

FSG participants and automotive supplier Forvia have a lot in common: passion for innovation, ambition and the courage to find creative mobility solutions. Faurecia and Hella combined under the roof of FORVIA group are proud to be a sponsor of the FSG! We are looking forward to exchanging ideas and wish everyone lots of success!

Die Teilnehmenden der FSG und der Automobilzulieferer Forvia haben vieles gemeinsam: Leidenschaft für Innovation, Ehrgeiz und den Mut zu kreativen Mobilitätslösungen. Faurecia und Hella, vereint unter dem Dach der FORVIA-Gruppe sind stolz, als Sponsor der FSG dabei zu sein! Wir freuen uns auf den Austausch von Ideen und wünschen allen viel Erfolg!

Christian Willenberg

Corporate Events

With over 7600 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 40 years of experience in developing innovative concepts and technologies for future vehicle generations. For further information about IAV, go to www.iav.com/en/careers

IAV ist mit über 7.600 Mitarbeitern weltweit einer der führenden Engineering-Partner der Automobilindustrie. Das Unternehmen entwickelt seit nunmehr 40 Jahren innovative Konzepte und Technologien für zukünftige Fahrzeuggenerationen. Weitere Infos zu IAV erhalten Sie über unser Karriereportal www.iav.com/karriere

Dr. Harald Straky

Vice President Product Development Electronics and Mechatronics

It is awesome to see the top performance of the future engineers and the resulting innovative vehicle concepts of the FSG. Particularly impressive is the omnipresent team spirit and the individual attitude to succeed. It is our duty at MAHLE to support and promote these young talents.

Es ist großartig, die Spitzenleistungen der angehenden IngenieurInnen und die daraus resultierenden innovativen Konzepte der FSG zu sehen. Besonders beeindruckend ist der allgegenwärtige Teamgeist und die klare Einstellung zum Erfolg. Es ist unsere Pflicht bei MAHLE, diese jungen Talente zu unterstützen und zu fördern.

Tamara Gabardi

Lead, Employer Branding & Recruiting Magna Powertrain

Magna's vision is advancing mobility for everyone and everything. We strive to innovate, we never settle and we do our best, when we do it together with confidence and by taking responsibility. We share this mindset and this passion with the racing teams and I am looking forward to a great racing season in 2023.

Die Vision von Magna ist es Mobilität für alle voranzutreiben. Wir streben nach Innovationen und Verbesserungen und erbringen die besten Leistungen, wenn wir selbstbewusst und verantwortungsvoll zusammenarbeiten. Dieses Mindset und diese Leidenschaft teilen wir mit den Renn-Teams der Formula Student und ich freue mich auf die Rennsaison 2023.

Rebecca Fahrnholz

Head of Recruiting & Employer Branding

We are a partner of Formula Student Germany, because – we want to support young people and their passion for engineering – we want to promote entrepreneurial thinking in the teams – it is simply great to believe in an idea and make it become reality – we are always looking for courageous students to revolutionize the commercial vehicle industry with us

Wir sind Partner der Formula Student Germany, weil – wir junge Menschen und ihre Passion für Entwicklung unterstützen wollen – wir das unternehmerische Denken in den Teams fördern wollen – es einfach großartig ist gemeinsam eine Idee Wirklichkeit werden zu lassen – wir gemeinsam mit mutigen Student:innen die Nutzfahrzeugindustrie revolutionieren wollen

MathWorks®

Dr. Veer Alakshendra
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

PORSCHE

Daniela Fiedler & Sebastian Saxer
Director HR Strategy & Employer Branding

Just like us at Porsche, the Formula Student teams are driven by dreams: We all put our heart and soul into making our dreams come true, day after day. We take courageous paths and face the challenges and the competition with sporting fairness - always with the one big dream in mind. We wish all participating teams exciting and successful days at the Hockenheimring and look forward to the exchange!

Genau wie wir bei Porsche sind auch die Formula Student Teams von Träumen angetrieben: Wir alle arbeiten Tag für Tag mit Herzblut an der Verwirklichung unserer Träume. Dabei gehen wir mutige Wege und stellen uns mit sportlicher Fairness den Herausforderungen und dem Wettbewerb - immer den einen großen Traum vor Augen. Wir wünschen allen teilnehmenden Teams spannende und erfolgreiche Tage am Hockenheimring und freuen uns auf den Austausch!

NIO

Victoria Wagner
Manager Talent Acquisition Europe

NIO is a pioneer of premium smart EVs. We have built our products around our community to deliver an experience beyond expectations. #BlueSkyComing is not only a claim – it's our philosophy. We are excited to share our ideas for the future of sustainable e-mobility with talented FSG participants.

NIO ist ein Pionier für smarte Premium-EV's. Wir haben unsere Produkte für unsere Community entwickelt, um ein einzigartiges Erlebnis zu bieten. #BlueSkyComing ist nicht nur ein Motto - es ist unsere Philosophie. Wir freuen uns darauf, unsere Ideen für die Zukunft der nachhaltigen E-Mobilität mit talentierten FSG-Teilnehmern zu teilen.

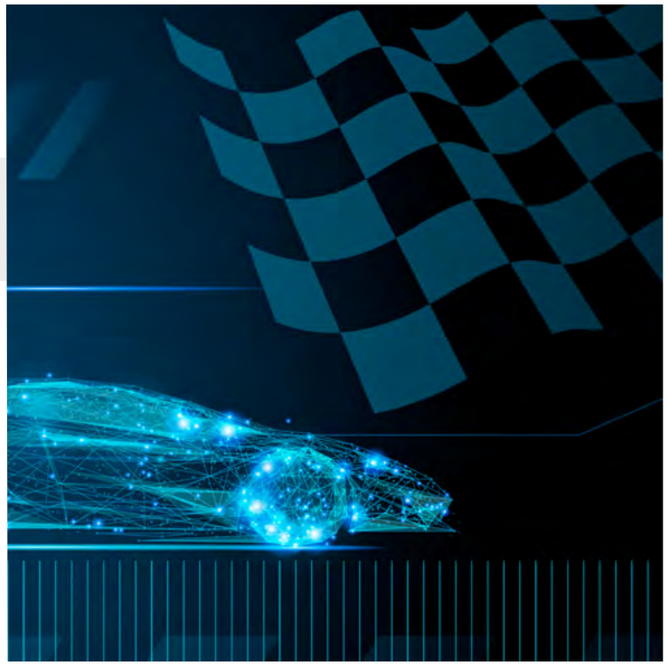
SCHAEFFLER

Corinna Schittenhelm
Chief Human Resources Officer

Team spirit, commitment and passion for technology & innovation – these are the hallmarks of the Formula Student teams. These are precisely the values that Schaeffler and its employees have always stood for and that will ensure our future success. We are proud of the strong bond between us and the Formula Student teams. Good luck to all of them!

Teamgeist, Engagement und Leidenschaft für Technik & Innovation – das zeichnet die Formula Student Teams aus. Das sind genau die Werte, für die Schaeffler und seine Mitarbeitenden immer stehen, um unseren zukünftigen Erfolg zu sichern. Wir sind stolz auf das starke Band zwischen uns und den Formula Student Teams. Wir wünschen allen viel Erfolg!

SIEMENS



Karl Hermann Dietz
Director Academic Business DACH

Team spirit, an infectious enthusiasm and the impressive professionalism of all the teams - that is what distinguishes the FSG. Siemens Digital Industries Software is 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. We look forward to talking to you at the booth.

Teamgeist, eine ansteckende Begeisterung und die beeindruckende Professionalität aller Teams - das ist es, was die FSG auszeichnet. Siemens Digital Industries Software ist 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. Wir freuen uns auf die Gespräche mit euch am Stand.

TESLA

Erik Demmler
HR Director Giga Berlin, Human Resources

Tesla's mission is to accelerate the world's transition to sustainable energy. Tesla was founded in 2003 by a group of engineers who wanted to prove that people didn't need to compromise to drive electric - that electric vehicles can be better, quicker and more fun to drive than gasoline cars. Today, Tesla builds not only all-electric vehicles but also infinitely scalable clean energy generation and storage products.

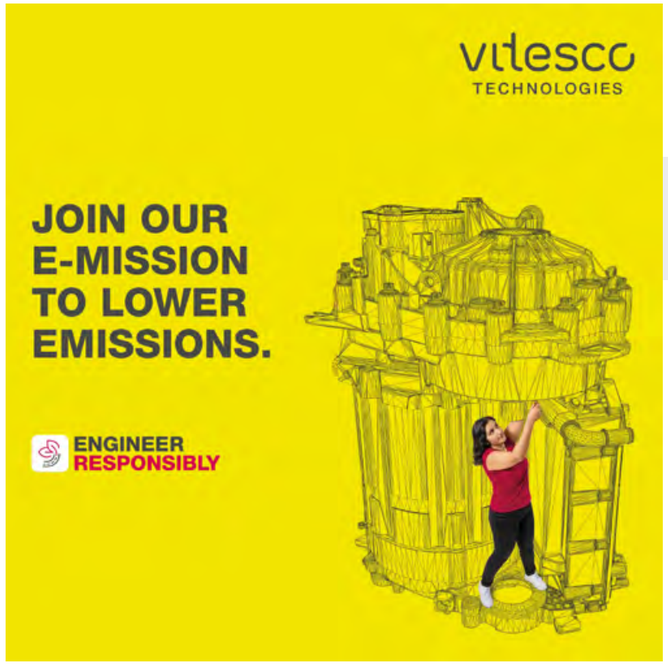
Tesla steht für eine Mission: Die Beschleunigung des Übergangs zu nachhaltiger Energie. Tesla wurde 2003 von einer Gruppe von Ingenieuren gegründet, die beweisen wollten, dass Elektrofahrzeuge keinen Kompromiss bedeuten, sondern mehr Leistung, Beschleunigung und Fahrspaß als Benziner bieten können. Heute baut Tesla neben reinen Elektrofahrzeugen auch unbegrenzt skalierbare Stromerzeugungs- und Stromspeicherprodukte.

VDI

Dipl.-Ing. Christof Kerkhoff
VDI-Society Automotive and Traffic Systems Technologies

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.



vitesco
TECHNOLOGIES

Susann Bösl
Head of EB & TMOD Germany

#weareelectrified - at Vitesco Technologies! With our vision ELECTRIFIED. EMOTION. EVERYWHERE. we are shaping the future of mobility. We are inspired by drive technologies for sustainable mobility - clean, smart and electrified. We don't just talk about transformation - we are the transformation!

#weareelectrified – bei Vitesco Technologies! Mit unserer Vision ELECTRIFIED. EMOTION. EVERYWHERE. gestalten wir die Zukunft der Mobilität. Uns begeistern Antriebstechnologien für nachhaltige Mobilität - sauber, smart und elektrifiziert. Wir reden nicht nur über die Transformation - wir sind die Transformation!

Dr. Karsten Bennewitz

Head of powertrain and energy system development,
Volkswagen AG

The world's changing – and we're changing with it. We are always looking for ambitious and motivated talents with whom we will shape our development towards electromobility and smart mobility. At Formula Student Germany there is the chance to talk about your opportunities at Volkswagen. We are looking forward to getting in touch with you!

Die Welt verändert sich – wir verändern uns mit. Wir sind daher immer auf der Suche nach ambitionierten und engagierten Talenten, die unsere Entwicklung zu Elektromobilität und Smart Mobility mit vorantreiben. Bei der Formula Student habt ihr die Gelegenheit, mit uns zu euren Chancen bei Volkswagen ins Gespräch zu kommen. Wir freuen uns auf euch!

Seeing beyond

Dr. Jens Werner

Head of Human Resources ZEISS SMT

To advance the technologies of tomorrow, you need bright minds and a strong team. That's why we are very happy to be part of "Formula Student Germany." It's not the team with the fastest car that wins here, but the one with the best overall package. Just like in motorsport, teamwork, precision and know-how are also required at ZEISS.

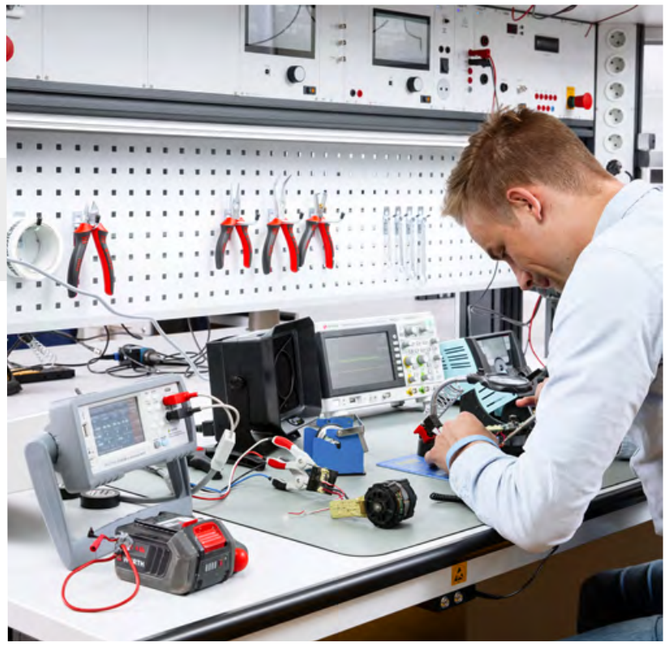
Um die Technologien von Morgen voranzutreiben, braucht es kluge Köpfe und ein starkes Team. Deshalb freuen wir uns sehr, bei der Formula Student Germany dabei zu sein. Hier gewinnt nicht das Team mit dem schnellsten Auto, sondern das mit dem besten Gesamtpaket. Genau wie im Motorsport sind auch bei ZEISS Teamwork, Präzision und Know-how gefragt.

Dr. Heiko Rosskamp

Head of Research and Development

As a leading manufacturer of fastening technology, Würth combines R&D, academic expertise, and experience in applications in its new Innovation Center. Our vision: more product and system innovation. We are looking for passionate and ambitious talents to help us achieve this vision, especially in the field of electronics and mechatronics!

Als führender Hersteller von Befestigungstechnik bringt Würth im Innovationszentrum Produktentwicklung, Hochschul-Know-how und Anwendungsexpertise zusammen. Das Ziel: Noch mehr Innovation bei Produkten und Systemen. Dafür suchen wir leidenschaftliche und ambitionierte Mitarbeitende – insbesondere auch mit Elektronik- und Mechatronik-Kenntnissen!



Martin Maas

Head of Employer Branding & Talent Attraction,
ZF Group

ZF is a global technology company, enabling the next generation of mobility and offering integrated solutions for vehicle manufacturers, mobility providers and start-up companies in the fields of transportation and mobility. We support Formula Student to give the participants early insights in our activities that shape the future of mobility.

ZF ist ein weltweit aktiver Technologiekonzern. Mit seinem Technologieportfolio bietet ZF Lösungen für Automobilhersteller, Mobilitätsanbieter und neu entstehende Unternehmen im Bereich Transport und Mobilität. Bei der Formula Student engagieren wir uns, um den Teilnehmern Einblicke zu geben, wie wir die Mobilität der nächsten Generation gestalten.

The Volunteers of FSG
Die Ehrenamtlichen der FSG

It takes more than 400 volunteers to bring Formula Student Germany to life every year. The team of volunteers functions like a well-oiled machine, tackling the ever-growing challenges of the annual event with honed skill and passionate dedication. The volunteers are divided into different groups according to their skill set. For example, there are the Scrutineers, the Judges, the Red Shirts and the White Shirts. These are people who handle the many tasks of planning, organising and running the event, as well as helping out and answering questions. The colour of their shirt will tell you what their role is at FSG.

Über 400 ehrenamtliche Helfer sind Jahr für Jahr an der Organisation und der Umsetzung der Formula Student Germany beteiligt. Wie eine gut geölte Maschine meistern sie mit Leidenschaft und Engagement die stetig wachsenden Herausforderungen, die das Event jedes Jahr aufs Neue mit sich bringt. Das eingespielte Team setzt sich aus verschiedenen Funktionsbereichen zusammen. So gibt es beispielsweise die technischen Inspektoren, die Juroren, die Red Shirts und die White Shirts, welche die Vielzahl an Aufgaben beim Planen, Organisieren und bei der Umsetzung vor Ort bewältigen und welche stets für Fragen rund um das Event zur Verfügung stehen. Anhand der Farbe ihres Shirts kann man leicht ihre Rolle bei der FSG erkennen.

You want to be part of the FSG community?
Then apply already now for the event in 2024.

Du möchtest Teil der FSG-Gemeinschaft werden?
Dann bewerbe dich bereits jetzt für das Event in 2024.

SCAN ME!

White Shirts 2023

FRANK RÖSKE
Board

RAINER KÖTKE
Board (FSG e.V. Finance)

CATHARINA SCHIFFTER
EC (Communications)

MATHIAS GEBHARDT
EC (Technical Inspection)

PHILIPP BANDOW
EC (Digital Officer)

STEFFEN HEMER
EC (FS-Driverless)

AARON BAUFELD
OT (Dynamics)

BJÖRN GERNERT
OT (IT)

CHRISTOPH BEISSWANGER
OT (Mechanical Inspection)

DANIEL BRONTSCH
OT (Cost Event)

ESTHER TROMP
OT (Event Management)

DANIEL MAZUR
Board (GmbH Managing Director)

LUDWIG VOLLRATH
Board (FSG External Relations)

TIM HANNIG
Board (FSG e.V. Chairman)

CHRISTIAN AMERSBACH
EC (Dynamics)

MORITZ HÖWER
EC (Rules + Scoring)

SEBASTIAN HOPPE
EC (Statics) & OT (Cost Event)

STEPHAN KRÜGER
EC (Event Support)

ANKE LACHMANN
OT (VIP Lounge & Culina)

BJÖRN TRANTA
OT (Pit Marshal)

CORVIN SCHINDLER
OT (Communications & Media)

DOMINIC WILDEBOER
OT (Dynamics)

FABIAN MAKNAPP
OT (Communications)

FABIAN LIESCH
OT (IT & TK)

JENNIFER STRATMANN
OT (Communications)

JET TUITERT
OT (Mechanical Inspection)

JOHANNES SCHWARZER
OT (Event Support)

KONRAD BAYER
OT (Event Support)

MATTHIAS BRUTSCHIN
OT (Security & Event Support)

NICOLE GEIER
OT (Event Control)

NORA LERINGER
OT (Event Control)

PASCAL HEUTER
OT (Pit Marshal)

ROBERT WEINGART
OT (Design Event)

SIMON DENSBORN
OT (Electrical Inspection)

THERESA STACH
OT (Communications)

YANNIC SCHRÖDER
OT (Timekeeping)

HINRICH GREFE
OT (Event Support)

JENS KEGELMANN
OT (Business Plan Presentation)

JOE MARTIN
OT (Design Event)

JUDITH MEININGER
OT (Special Awards)

LEA VAUDLET
OT (Event Control)

NICOLAS VELZ
OT (Driverless Inspection)

NIKLAS HEIN
OT (Dynamics)

OLIVER MARTYNUS
OT (Event Support)

PHILIPP VAUDLET
OT (Event Control)

SARAH BATTIGE
OT (Electrical Inspection)

TANJA HOFMANN
OT (Culina)

TIMO JEITNER
OT (Event Support)

The **White Shirts** are in charge of the yearlong task of planning the event and of ensuring that everything falls into place as it should on race day. They are the "go-to" people for sponsors, press, participants and visitors and they ensure that the competition runs without a hitch.

Die **White Shirts** sind für die ganzjährige Planung der Veranstaltung und deren reibungslose Umsetzung an den Renntagen verantwortlich. Sie sind Ansprechpartner für Sponsoren, Medienvertreter, Teilnehmer und Besucher und stellen sicher, dass der Wettbewerb ohne Komplikationen verläuft.

STATUS/STAND: 10.07.2023

Blue Shirts 2023

Since FSG is essentially a design competition, a team's scoring in the static disciplines is a big factor in its overall standing. It is the job of the judges in their blue shirts to render these scorings. They look at the design, manufacturing quality and cost planning; they consider the economics of the project and whether the business plan is convincing. For this, they utilize their professional expertise, indispensable honesty and constructive criticism. Their feedback has resulted in the extensive improvements from the teams over the past years.

Da es sich bei der FSG im Wesentlichen um einen Konstruktionswettbewerb handelt, tragen die statischen Disziplinen im erheblichen Maße zur Gesamtwertung bei. Die in **blau gekleideten Juroren** bewerten die Entwicklung, Fertigungsgüte sowie das Kostenbewusstsein der Studierenden. Sie betrachten die Wirtschaftlichkeit des Gesamtprojektes ebenso wie die Präsentation der detaillierten Geschäftspläne, nutzen dabei ihre Expertise und geben unvergleichlich ehrliche sowie konstruktive Kritik, welche bereits in vergangenen Jahren positiv zur Weiterentwicklung der Studierenden beigetragen hat.

Business

BAUER, Christina / **BJEKOVIC**, Robert / **BURKHARDT**, Thomas / **CAVIGLIA**, Alberto / **ESSER**, Klaus / **GEIGLE**, Monika / **HAHN**, Thomas / **HEIDEMEYER**, Peter / **HERRMANN**, Jesko / **HERZHAUSER**, Erik / **HODGKINSON**, Raymond George / **KLUG**, Jens / **LINDNER**, Max / **MERKL**, Julia / **NUSCHELER**, Barbara Christine / **PETERS**, Jan / **REICHELT**, Carolin / **REICHL**, Dominik / **SCHIELKE**, Daniel / **STRATEMEIER**, Frank / **TABATABAI**, Stefan / **THELEMANN**, Corbinian / **VADEHRA**, Bernhard Prem / **VOLLRATH**, Laura / **WALLUSCH**, Nina / **WARTEN**, Paula / **WEINELT**, Dieter / **WELK**, Svenja / **WENZEL**, Frank

Cost

ANDRES ATIENZA, David / **BERTRAM**, Michael / **BLASCHCZOK**, Thomas / **ELSAED**, Essam / **GRUNDNER**, Harald / **HAGL**, Markus / **KOCH**, Richard / **KOELLNER**, Torsten / **KÖHN**, Maximilian / **KOURTIDIS**, Apostolos / **KRONMAIER**, Marcus / **KÜHNE**, Alexander / **KURZEN**, Michael / **LUNDBERG**, Alexander / **MICHEL**, Martin / **MÜLLER**, Karsten / **NEIDINGER**, Jan / **POLAT**, Ceren / **RÖTZ**, Daniel / **SEHGAL**, Gagan / **STEINMEIER**, Frank / **WIELSCH**, Stefan / **WINKLER**, Tino / **WOLPERT**, Sven

Design

AERTS, Joris / **ALAKSHENDRA**, Veer / **BANSAL**, Amar / **BIECHELE**, Simon / **BIEDERMANN**, Benjamin / **BLICKENSDORFF**, Johannes / **BÖHNERT**, Andreas / **BRAIG**, Johannes / **BRANDAUER**, Andreas / **BRASSEUR**, Jeff / **BREINLINGER**, Philipp / **CHATZICHARALAMPOUS**, Eleftheria / **CINAR**, Jeyan / **CULLEY**, Jacob / **D'HAEN**, Jonas / **DACHS**, Oriol / **DECKERS**, Jean-Noel / **DIPPOLT**, Alexander / **ENDER**, Stefan / **ERCHINGER**, Dominik / **FERRAZ DE OLIVEIRA**, Matheus / **FRITZ**, David / **FRIZOT**, Florian / **FROISSARD**, René-Pierre / **GARDUNO**, Luis / **GARYUK**, Grygoriy / **GEHRKE**, Lars / **GEIGER**, Andreas / **GEISER**, Hannes / **GINETE**, Joao / **GÍSLASON**, Óttar / **GLÖCKLER**, Jonas / **GOLLOB**, Christoph / **GORASIA**, Jay / **GOY**, Florian / **GROSS**, Stephan / **GRUBER**, Gregor / **GUACCI**, Mattia / **HAIDAI**, Valentin / **HANISCH**, Thomas / **HERFARTH**, Jonas / **HILLEBRAND**, Svenja / **HOBMAIER**, Simon / **HOFMANN**, Marvin / **HÖLZGEN**, Andre / **HSIAO**, Paul / **HÜBSCHMANN**, Paul / **IZQUIERDO SUSÍN**, David / **KALANKE**, Philipp / **KASIRI**, Ghoncheh / **KHARITONOV**, Ivan / **KRISHNAKUMAR**, Ajinkya / **LEUTENMAIER**, Rainer / **LEUTENMAIER**, Rainer / **LIEBST**, Fabian / **LINGUANOTTO**, André / **MANDELLI**, Marco / **MATA**, Nuria / **MEINKE**, Niels / **MISSLER**, Christian / **MÜLLER**, Marko / **NOETZIG**, Lars / **NÖTZIG**, Lars / **PANGERL**, Jonas / **PEČANIĆ**, Matko / **POLAT**, Can / **ROBERT**, Fabian / **ROUELLE**, Claude / **RUDOLPH**, Martin / **RUHL**, Stefan / **RUPNAWAR**, Sandip / **SANTOS MORGADO DA COSTA**, Fabio / **SAYOVITZ**, Steve / **SCHABERT**, Martin / **SCHÄFER**, Simon / **SCHÄFER**, Tom / **SCHEUERMANN**, Michael / **SCHMIDT**, Franziska / **SCHMÜLLING**, Christoph / **SCHULZ**, Mario / **SERNÉ**, Ton / **SORGE**, Jordan / **SPEK**, Gert / **STEINLE**, Claus / **STEINMANN**, Rico / **STOBER**, Benjamin / **STOLLE**, Ludwig / **TONG**, Son / **TORGOVNIKOV**, Eugen / **TOYE**, Bart / **UPADHAYAY**, Pranshu / **VAN DER PLOEG**, Chris / **VAN MOORSEL**, Len / **VELA**, Nicolas / **WAGH**, Jay / **WEBER**, Martin / **WEBER**, Thomas / **WEICHEL**, Benedikt / **WEIDL**, Florian / **WERNER**, HP / **WIESINGER**, Michael / **WITTE**, Christian / **WÖHLER**, Konrad / **WUNSCHHEIM**, Lukas / **ZIMMERMANN**, Hannes

STATUS/STAND: 10.07.2023

Red Shirts 2023

The **red shirts** have jurisdiction over event control and event support. The support team takes care of building up and taking down of every physical transformation that turns the Hockenheim Ring into Formula Student Germany. We need them to ensure that the event runs smoothly. They also act as the track marshals during dynamic events.

As Event-Control-Team they are serving as intermediaries between visitors, team members, sponsors and press, so that nobody on the FSG grounds can 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.

Die **Red Shirts** sind für die Bereiche „Event-Control" und „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.

Das Event Control-Team bildet 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.

AGUDO MARTÍN, Rafael / **APARICIO ALONSO**, Jorge / **BAGER**, Magnus / **BAIOLI**, Stefano / **BAL**, Lalatendu / **BAROLO**, Emanuele / **BEDENK**, Lena / **BORRMANN**, Daniel / **BRÜGGEMANN**, Felix / **CARBONE**, Federico / **COTOBAL**, Adrián / **DAL FARRA**, Filippo / **DESINGER**, Karina / **ELSAED**, Essam / **ENRÍQUEZ ROMERO**, Rafael / **FARAG**, Mohamed / **FRIZZARIN**, Elena / **GONZÁLEZ LUNA**, Cristina / **GRASSHOFF**, Anna / **HACIOGULLARI**, melike / **HARTNER**, Tom / **HERRERA CAZAR**, Marina / **HIREMATH**, Vaibhav Shanmukhayya / **HOFMANN**, Peter / **JONAS**, Kevin / **KIPRIJANOVA**, Sara / **KLEIN**, Christian / **KOLB**, Luise / **KOTLARSKI**, Tobias / **KRISTANDT**, Nils / **LANSNICKER**, Liv / **LANSNICKER-DIETRICH**, Bärbel / **LEHKOBYT**, Oleksandra / **LEHMANN**, Alexandra / **LILIE**, Ky Nam / **LUGOSI**, Lilla / **MANIKANDAN**, Praveen / **MARIYADA**, Sushmitha / **MESA MUÑOZ**, Pablo / **MOLITOR**, Juliane / **MÜLLER**, György / **MÜLLER**, Lars / **NEUMANN**, Svenja / **OROZCO PALMERO**, Daniel / **PASZKIEWICZ**, Maria / **PÉREZ MENDOZA**, Ana Cristina / **PETERS**, Jannik / **PISSARRECK**, Mona / **PLATTNER**, Nikolas / **PROSSEL**, Dominik / **RATH**, Alexander / **RELL**, Alina / **RODRIGUEZ SOCCIO**, Marco Javier / **SARTORETTO**, Riccardo / **SCHOTT**, Toni / **SEBŐ**, Áron / **SOBRINO YÁÑEZ**, Álvaro / **SZABO**, Agnes / **TÓTH**, Álmos Dávid / **VAUDLET**, Oliver / **WEIHE**, Sebastian / **WEITZ**, Klara / **WIEDEMANN**, Timo / **ZASTROW**, Maik / **ANAND**, Vaibhav / **CZORNY**, Noah / **DEMEURICY**, Paul / **DIETRICH**, Franziska / **DINKGREFE**, Lukas / **FINDEISEN**, Jan / **GRASSHOFF**, Lara / **HELFENSTEIN**, Lukas / **HENNIGES**, Christoph / **KOHLER**, Fabian / **MANIVANNAN**, Navaneet Gokul / **MARTÍN DELGADO**, Francisco Javier / **MOHAMMED**, Mahmoud Moustafa Mahmoud / **MWEMA**, Faith / **NUILA HERNÁNDEZ**, José Julián / **PANDEY**, Rahul / **PENCHALWAR**, Nikhil Srinivas Rao / **PHAM**, Phong / **PRAJAPATI**, Kajal / **PRENZEL**, Mira / **RAO**, Mandar / **ROUTRAY**, Anubhav / **SARTORI**, Alessandro / **SCHMITT**, Steffen / **SCHUDINAT**, Erik / **SHAH**, Shanay / **SIDHIQUE**, Basith / **THOMAS**, Leon Maxwell / **VADLAMUDI**, Yasonandan / **ZEILE**, Christian

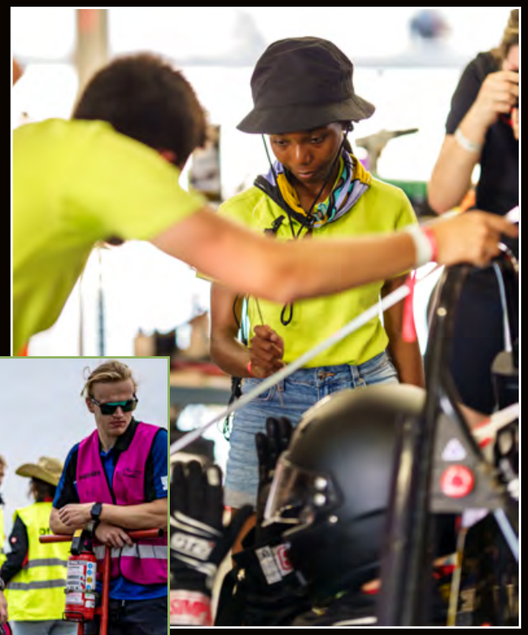
STATUS/STAND: **10.07.2023**

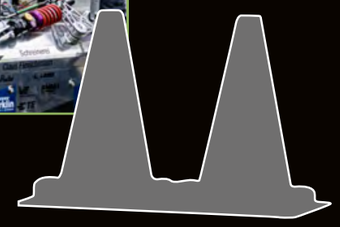
Scrutineers 2023

The **Scrutineers** – the folks in **green** –are there to guarantee that all the vehicles are safe. They accomplish this by meticulously checking the cars for potential safety hazards and patiently assisting 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 shirted** volunteers.

Die Scrutineers (technische Inspektoren) – die „Leute in **Grün**" – überprüfen die Sicherheit aller teilnehmenden Fahrzeuge. Sie kontrollieren die Boliden der Teilnehmer akribisch genau auf etwaige Sicherheitsmängel und stehen den Teams bei technischen Problemen mit ihrer Expertise helfend zur Seite (sowohl am Event selbst, wie auch während des Jahres). Als Team darf man ohne die Freigabe unserer **grün gekleideten** Helfer nicht an den dynamischen Disziplinen teilnehmen.

ALT, Janine / **BÄUERLEIN**, Sonja / **BAYERLEIN**, Michael / **BECKMANN**, Lukas / **BENDER**, Simon / **BERWALD**, Alexander / **BRECHTMANN**, Nick / **BROCKMANN**, Jan Thieß / **BROVOLD**, Jostein / **BUSCHHAUS**, Samuel / **CANE**, Rodrigo / **CHRISTIDIS**, George / **CLEMENS**, Oliver / **DIETZEL**, Michael / **FABIANO**, Giuseppe / **FERREIRA**, Ricardo / **FRIEDEMANN**, Max / **GAIDETZKA**, Max / **GIEST**, Carl / **GOSALA**, Dheeraj Bharadwaj / **GREMER**, Michaela / **GROEZINGER**, Conrad / **GUPTA**, Shivam / **HEIDBRINK**, Max / **HEINRICH**, Tobias / **HERGESELL**, Philipp / **HOHMANN**, Christof / **HOHMUTH**, Richard / **HORAT**, Andreas / **HÖRSCH**, Moritz / **HÜBL**, Lukas / **IZQUIERDO SUSÍN**, David / **JADE**, Shardul / **JÄGER**, Daniel / **KENGELBACHER**, Vincent / **KLECKNER**, Laura / **KLEIN**, Julian / **KUSHARE**, Pavan / **LÓPEZ ESTRUEL**, Nicolás / **MAASS**, Philipp / **MAUL**, Ralf / **MÜLLER**, Marko / **MÜLLER**, Winfried / **MUSCHALLE**, Carsten / **NEFF**, Volker / **NITSCHE**, Lukas / **NOACK**, Jan Ole / **OEHMKE**, Martin / **OHLY**, Niklas / **PANG**, Jacky / **PECHINGER**, Mathias / **PLETSCHKE**, Tobias / **POLT**, Markus / **PUROHIT**, Suhrud / **ROSSAK**, Philipp / **RUPPRECHT**, Stefan / **SARRÓ VERDÚ**, Alejandro / **SCHULTE**, Tim / **SCHÜTZE**, Thomas / **SETZ**, Max / **SEYFFER**, Norman / **SHARMA**, Ram Krishan / **SISKOS**, Alexandros / **STEIN**, Christopher / **STEINFURTH**, Ulf / **THOMASSEN**, Kevin / **TIEMANN**, Maik / **VAN DEN BRANDT**, Dennis / **VINER**, Alexander / **WEBER**, Sebastian / **WINZ**, Daniel / **YAVUZ**, Hakkı





STATUS/STAND: 10.07.2023

Communications & Media, Timekeeping & IT 2023

Finally, we have the FSG **media team**, whose contributions through their videos, pictures and social media content materials of exceptional quality and creativity, allow us to relive the most stunning and unforgettable moments of the event again and again, long after the smoke from the tires of the race cars has cleared.

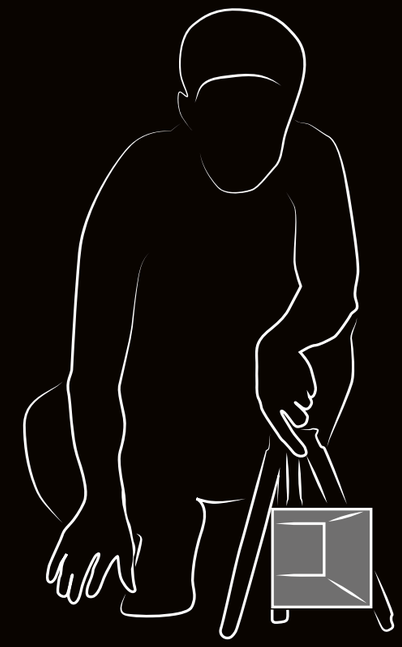
Zu guter Letzt leistet das ebenfalls in **schwarz gekleidete Media-Team** in Form von Videos, Bildern und Social Media Content seinen Beitrag, und sorgt mit beeindruckender Kreativität und Qualität dafür, dass wir die schönsten und unvergesslichsten Momente des Events auch lange nachdem sich der letzte Rauch qualmender Reifen verzogen hat, noch einmal durchleben können.

Communications & Media

ĀBOLS, Ralfs Mārcis / **ALNAFOUS**, Karam / **ANDRAE**, Camilla Luisa / **AUGUSTO MEHL**, Carolina / **DSOUZA**, Renita / **FRANK**, Simon / **FURTADO**, Crystal / **GROBE**, Axel / **HAINDL**, Leon / **HOLTERMANN**, Jonas / **HORÁK**, Karel / **JUNG**, Alexa / **KOHLER**, Anton / **LODHOLZ**, Felix / **MARU**, Vivek / **PARTENFELDER**, Maximilian / **PETERS**, Marcel / **RAMSURRUN**, Asheil / **RANKIN**, Alastair / **RAUBER**, Julian / **SCHIEWE**, Yannic / **SEIZINGER**, Paul / **SIEVERS**, Tjark / **TARAS**, Victor / **TOSCH**, Sven / **WEBER**, Julia / **WINTERMANTEL**, Patrick / **ZEHNDER**, Elena

Behind the scenes we have the **IT experts**, who are tasked with timekeeping during the dynamic disciplines 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 – along the entire event site!

Ebenfalls oft im Verborgenen arbeiten unsere in schwarz gekleideten **IT Spezialisten**, welche für die Zeitnahme bei den dynamischen Disziplinen verantwortlich sind und sicherstellen, dass jedes 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 Verfügung!



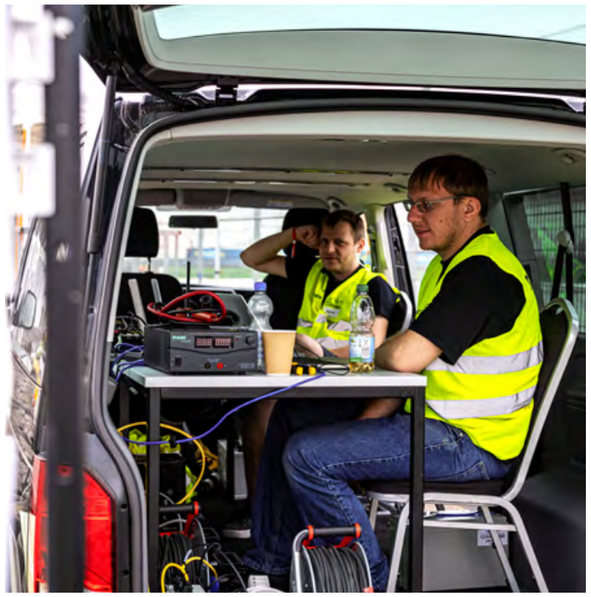
Timekeeping & IT

CONDE, Sergio / **GARLICHS**, Keno / **HAUFFE**, Björn / **IDZIK**, Piotr / **LENNER**, Maximilian / **PETERSEN**, Torben / **SCHLICHTER**, Jan / **STAMPRATH**, Christoph / **TIMMERMANS**, Tristan / **VAN BALEN**, Johannes / **VAN LEEUWEN**, Tom

STATUS/STAND: **10.07.2023**

Impressions

2022

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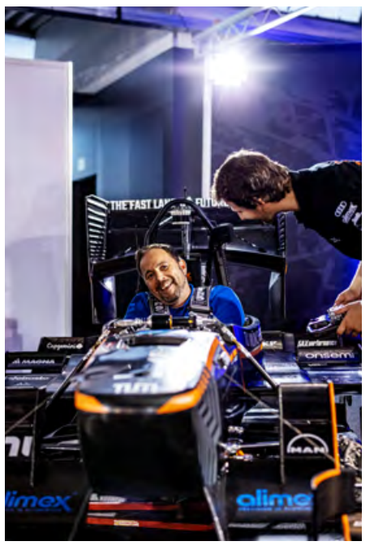
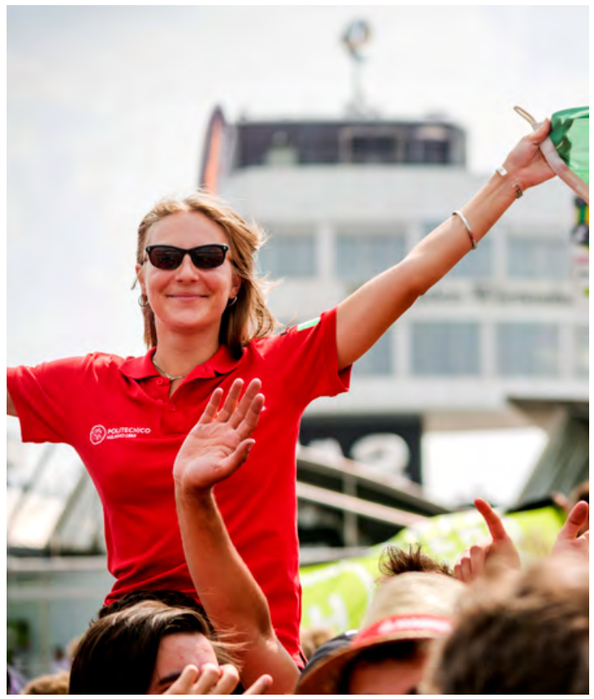
RWTH AACHEN




GERMANY
INTERNATIONAL DESIGN COMPETITION
Team e-gnition Hambu
Country Germany


UAS NUREMBERG



Tipps & Tricks:
Cost & Manufacturing Event

Written by Julia Weber & Elena Zehnder

Formula Student is an interdisciplinary design competition that requires not only engineering skills, but also cost understanding and business savvy. This article presents the most important elements of the Cost & Manufacturing Event and is intended to help teams to prepare for this event.

This article was written in cooperation with Sebastian Hoppe - EC Statics & OT Cost Event FSG and Daniel Brontsch - OT Cost Event FSG.

Die Formula Student ist ein interdisziplinärer Konstruktionswettbewerb bei dem nicht nur Ingenieurswissen gefragt ist, sondern auch Kostenverständnis und Geschäftssinn. Dieser Artikel stellt die wichtigsten Elemente des Cost & Manufacturing Events vor und soll den Teams bei der Vorbereitung helfen.

Der Artikel ist in Zusammenarbeit mit Sebastian Hoppe - EC Statics & OT Cost Event FSG und Daniel Brontsch - OT Cost Event FSG entstanden.

General Information

The first step is to familiarize yourself with the Cost Tool and its rules. To begin, you should think carefully about how you want to set up the Cost Report Documents (CRD) and come up with a structure that you will follow. This can be an Excel list, a project management tool, a BOM exported from CAD, or a list on the whiteboard in your workshop. Once you have an overview, work out a reasonable schedule - even though deadlines always seem far away, it takes time to prepare good and detailed CRDs.

> *"The close work with the technical departments is absolutely essential, especially for the C- and DBOM. The sub-team leaders know their parts inside out and you must use their knowledge and work together for a successful Cost Report."*
>
> *Marius Kugler, Rennstall Esslingen*

Everyone involved must know the vocabulary and how the car is fundamentally structured. The same applies to the basics of cost accounting and the parameters of the Costed Bill of Material (CBOM).

> *"Building a race car is a team effort, as is the cost report. As the cost manager, it's impossible to know every part and its manufacturing process. For this reason, it is important to work together as a team"*
>
> *Jonas König, Highspeed Karlsruhe*

For detailed questions, of course, you can always refer to the relevant expert. For effective preparation, it is also advisable to do some pre-judging with alumni or sponsors. Through their experience, they can give hints if e.g. something is missing in the Bill of Material (BOM).

Generelle Informationen zum Cost Report

Der erste Schritt ist, dass ihr euch mit dem Cost Tool und den Regeln vertraut macht. Zu Beginn solltet ihr genau überlegen, wie ihr die Cost Report Documents (CRD) aufbauen möchtet und euch eine Struktur überlegen, der ihr folgt. Ob ihr eine Excel Liste, ein Projektmanagement Tool, eine aus dem CAD exportierte BOM oder eine Liste an der Tafel in eurer Werkstatt nutzt, ist euch überlassen. Sobald ihr einen Überblick habt, erarbeitet einen sinnvollen Zeitplan – auch wenn die Deadlines immer weit entfernt scheinen, dauert es seine Zeit, gute und detaillierte CRD vorzubereiten. Beim Cost Event können durch gute Vorbereitung bereits vor dem eigentlichen Event viele Punkte gesammelt werden und im Idealfall werden die Cost Report Document parallel zur Fertigungsphase vorbereitet.

> *„Die enge Zusammenarbeit mit den technischen Abteilungen ist absolut notwendig, besonders für die C- und DBOM. Die Sub-Teamleiter kennen ihre Teile in- und auswendig und man muss ihr Wissen nutzen und zusammenarbeiten, um einen erfolgreichen Cost Report zu erstellen."*
>
> *Marius Kugler, Rennstall Esslingen*

Alle Beteiligten müssen die Vokabeln kennen und wissen, wie das Auto grundlegend aufgebaut ist. Selbiges gilt für die Grundlagen der Kostenrechnung und die Parameter der Costed Bill of Material (CBOM).

> *„Der Bau eines Rennwagens ist eine Teamleistung, ebenso wie der Cost Report. Als Kostenverantwortlicher ist es unmöglich, jedes Teil und dessen Herstellungsprozess zu kennen. Aus diesem Grund ist es wichtig, als Team zusammenzuarbeiten."*
>
> *Jonas König, Highspeed Karlsruhe*

Für Detailfragen kann natürlich immer an den jeweiligen Experten verwiesen werden. Für eine effektive Vorbereitung ist es außerdem ratsam, ein Pre-Judging mit Alumni oder Sponsoren durchzuführen. Diese können durch Ihre Erfahrung Hinweise geben, ob z.B. in der Bill of Material (BOM) etwas fehlt.

Bill of Material (BOM)

Bei der **BOM** können am einfachsten Punkte gesammelt oder verloren werden. Da hier nur eine Teileliste verlangt ist, kann euer CAD Gesamtmodell als Ausgangspunkt dienen. Allerdings solltet ihr vor der Abgabe die Liste mit dem Fahrzeug abgleichen, falls neue Teile hinzugekommen sind, welche nicht im CAD vorgesehen waren.

Das Motto der **Detailed Bill of Material (DBOM)** lautet: so detailliert wie möglich, aber nur so komplex wie nötig. Als Tipp kann man sich die DBOM wie ein Kochrezept vorstellen, die einzelnen Schritte müssen einfach nachvollzogen werden können. Erstellt im Vorfeld Standardprozesse, die mehrmals wiederholt werden, z. B. das Laminieren. So habt ihr ein einheitliches Wording, was den Judges erleichtert, die Prozesse nachzuvollziehen. Außerdem werden so kleine Schritte, z. B. das Entgraten von Bauteilen, nicht vergessen. Diese Standardprozesse müssen dann je nach Bauteil angepasst werden.

> *„Um ein tiefes Verständnis für den Produktionsprozess zu erlangen und bei der BOM - Diskussion mit Detailwissen glänzen zu können, kann es ein echter Game-Changer sein, zumindest einmal Teil des Produktionsprozesses gewesen zu sein - vor allem als BWL-Student."*
>
> *Elena Zehnder, StarkStrom Augsburg, Alumna*

Wichtig ist auch der Fertigungsprozess: zuletzt müssen alle Teile zusammengebaut werden - nur so ist das Fahrzeug in der vom Reglement vorgesehenen "ready to race" condition.

Bill of Material (BOM)
The BOM is the easiest document to collect or lose points. Since only a parts list is required here, your CAD model can serve as a starting point. However, you should compare the list to the actual vehicle before submitting it in case new parts have been added that were not planned in the CAD.

The motto of the Detailed Bill of Material (DBOM) is as detailed as possible, but only as complex as necessary. As a tip, you can think of the DBOM like a cooking recipe; the individual steps must be easy to follow. Create standard processes in advance that are repeated several times, e. g. lamination. This way you have consistent wording, which makes it easier for the judges to follow the processes. In addition, small steps, e. g. deburring of components, are not forgotten. These standard processes must then be adapted depending on the component.

> *"To gain the necessary in-depth understanding of the production process and present an excellent knowledge at the BOM discussion, it can be a real game-changer to have performed the production process at least once yourself - especially as a business student preparing the CRD."*
>
> *Elena Zehnder, StarkStrom Augsburg, Alumna*

The assembly process is also important: all parts must be assembled as a last step - this is the only way to ensure that the vehicle is in the "ready to race" condition specified by the rules.

For the CBOM, the procedure is basically the same as for the DBOM. Work according to the motto: think first, then act! First collect all necessary inputs, the associated costs and structure your costing model. Only when this framework is set up, you start to calculate the actual costs of the manufacturing processes.

> *"Attention to detail is paramount in the Cost Event. Master the part production processes and never underestimate the vital role of meticulous documentation."*
>
> *Robert-Juss Soe, FS Team Tallinn*

Cost Explanation File (CEF)
The CEF helps the judges to get an overview of your cost accounting method in advance. It must contain your cost model as well as the inputs used, i.e. material, labor and machine costs.
The judges have only little time to prepare in advance, so well-structured documents that follow a red thread are an advantage. You can achieve this, for example, by using a uniform numbering and naming of the components in all documents, so that it is possible to switch between the individual documents quickly and without a long search. A good structure also benefits you.

The understanding behind the calculations is crucial. You must show that e. g. you understand how a machine hourly rate is calculated.

Also, state the source of your information - just saying you got the rates from a sponsor is not enough. Instead use for example accounting laws as a basis. Of course, the document must be free of spelling or formatting errors. Finally, only include knowledge that you can explain in a well-founded way - after all, it's about understanding costs.

Supporting Material File (SMF)
For the SMF, try to put yourself in the judges' shoes as to what drawings you would want to see if you had the car in front of you.

A detailed SMF creates transparency and trust with the judges. Since it helps them to visualize things, it should be as detailed as possible, especially since you have usually already made the drawings.

While pictures and drawings are an essential part of the SMF, data sheets of standard parts like screws, documentation/manuals of electrical components (e. g. motors, unless these are in-house developments) do not belong in the SMF. Finally, it is important in the SMF that the DBOM and CBOM assemblies are represented in an understandable way.

Für die **CBOM** gilt grundsätzlich das gleiche Vorgehen wie bei der DBOM. Arbeitet hier nach dem Motto: zuerst Denken, dann Handeln! Sammelt zuerst alle notwendigen Inputs, die zugehörigen Kosten und strukturiert euer Kostenmodell. Erst wenn diese Grundlagen bereitliegen, beginnt ihr damit, die tatsächlichen Kosten der Fertigungsprozesse zu berechnen.

> *„Beim Cost Event ist die Liebe zum Detail das A und O. Man sollte die Prozesse zur Herstellung der Komponenten beherrschen und die wichtige Rolle einer sorgfältigen Dokumentation nicht unterschätzen."*
>
> *Robert-Juss Soe, FS Team Tallinn*

Cost Explanation File (CEF)
Das CEF hilft den Judges, bereits im Voraus einen Überblick über eure Kostenrechnungsmethode zu erhalten. Enthalten sein muss euer Kostenmodell sowie die verwendeten Inputs, also Material-, Lohn- und Maschinenkosten.

Die Judges haben im Voraus nur wenig Zeit sich vorzubereiten, gut strukturierte Dokumente welche einem roten Faden folgen sind also von Vorteil. Dies könnt ihr z. B. nur eine einheitliche Nummerierung und Benennung der Bauteile in allen Dokumenten erreichen, sodass schnell und ohne langes Suchen zwischen den einzelnen Dokumenten gewechselt werden kann. Eine gute Struktur kommt auch euch zugute.

Das Verständnis hinter den Berechnungen ist entscheidend. Ihr müsst zeigen, dass ihr verstanden habt wie beispielsweise ein Maschinenstudensatz berechnet wird.

Gebt außerdem die Quelle eurer Informationen an - lediglich zu sagen, ihr habt die Preise von einem Sponsor erhalten, reicht nicht aus. Nehmt euch stattdessen beispielsweise Rechnungslegungsgesetze als Grundlage. Selbstverständlich muss das Dokument frei von Rechtschreib- oder Formatierungsfehlern sein. Zuletzt inkludiert nur Wissen, welches ihr fundiert erklären könnt, schließlich geht es um Kostenverständnis.

Supporting Material File (SMF)
Versucht euch für das SMF in die Lage der Judges zu versetzen, welche Zeichnungen ihr sehen wollen würdet, wenn ihr das Fahrzeug vor euch stehen habt.

Ein ausführliches SMF schafft Transparenz und Vertrauen bei den Judges. Da es ihnen hilft Sachen sichtbar zu machen, sollte es so detalliert wie möglich sein – zumal ihr die Zeichnungen in der Regel schon angefertigt habt.

Während Bilder und Zeichnungen ein essenzieller Bestandteil des SMF sind gehören Datenblätter von Normteilen wie Schrauben, Dokumentationen/Handbücher elektrischer Komponenten (z.B. Motoren, außer diese sind Eigenentwicklungen) nicht ins SMF. Abschließend ist es im SMF wichtig, dass vor allem die DBOM und CBOM Baugruppen verständlich repräsentiert sind.

Cost Understanding Discussion (CUD)
For the development of the CUD, rules from previous years can be inspected as a guideline - but it is absolutely necessary to think far outside the box.

> *"Cost can be seen as an event with very little freedom, the judges see the same parts one after the other, which is why the serving is what brings you points. With complex, unique thinking and the proper connection of different areas, very nice results can be achieved."*
>
> *Bettina Szelezsán, Arrabona Racing Team*

It is helpful to select a component from the CBOM (e. g. your favorite part) and to create a holistic example for it. Furthermore, it is important: Even though it is called Cost Understanding Discussion, it is not just a talk. Design posters, slides, rollups, etc. on which your calculations, tables and drawings are shown, and bring spare parts to show components that are difficult to see on the vehicle. In summary, the CUD is not just a question-and-answer game, but you must apply methods, make calculations, and present detailed as well as sound reasoning as to why a decision was made on the vehicle and how. The CUD can thus be compared to Engineering Design, only here it is about the economic side of the decision-making process in vehicle design.

Real Case
The topic of the Real Case will be published about three to four weeks prior to the event. The development of the Real Case is best done in an interdisciplinary way with your cost managers from business and engineering and additionally with an expert on the Real Case topic. In contrast to the CUD, the Real Case is comparable to the Business Plan: prepare your flipcharts and key statements in a structured way and support them with calculations and pictures. In the 10 minutes you have to answer the given topic clearly, but be prepared for the judges to ask questions if necessary. The Real Case should show that you are able to combine technical and economic know-how with a short preparation time, apply it and finally present it in a comprehensible way.

Cost Understanding Discussion (CUD)
Während noch vor einigen Jahren die Themen der Cost Understanding Discussion vom Regelwerk vorgegeben waren, ist die Spielwiese jetzt größer. Es kann sich aber dennoch an den Themen von damals orientiert werden, allerdings solltet ihr auch über den Tellerrand hinausblicken. Hilfreich ist, ein Bauteil aus der CBOM auszuwählen und hierzu ein gesamtheitliches Beispiel zu erstellen.

> *„Das Cost Event kann als Disziplin mit sehr wenig Freiheit gesehen werden, die Judges sehen immer die gleichen Teile nacheinander, deshalb ist es das Präsentieren, das Punkte bringt. Mit komplexem, einzigartigem Denken und der richtigen Verbindung der verschiedenen Bereiche können sehr gute Ergebnisse erzielt werden."*
>
> *Bettina Szelezsán, Arrabona Racing Team*

Weiterhin wichtig ist: Auch wenn es Cost Understanding Discussion heißt, ist es nicht nur ein Gespräch. Gestaltet Plakate, Folien, Rollups etc. auf welchen eure Kalkulationen, Tabellen und Zeichnungen dargestellt sind. Zusammengefasst ist die CUD nicht nur ein Frage- und Antwortspiel, sondern ihr müsst Methoden anwenden, Kalkulationen anfertigen und detaillierte, sowie fundierte Argumentationen präsentieren, warum eine Entscheidung am Fahrzeug wie getroffen wurde. Die CUD kann mit dem Engineering Design verglichen werden, lediglich geht es hier um die wirtschaftliche Seite des Entscheidungsprozesses in der Konstruktion.

Real Case
Das Thema des Real Case wird ca. 3 bis 4 Wochen vor dem Event veröffentlicht. Die Erarbeitung erfolgt am Besten interdisziplinär mit euren Cost Verantwortlichen aus Wirtschaft sowie Ingenieurwissenschaften und zusätzlich einem Experten zum Real Case Thema. Im Gegensatz zur CUD ist der Real Case vergleichbar mit dem Business Plan: bereitet eure Flipcharts und Kernaussagen strukturiert vor und unterstützt diese mit Kalkulationen und Bildern. In den ca. 10 Minuten muss das gestellte Thema klar beantwortet werden, stellt euch aber darauf ein, dass die Judges gegebenenfalls Rückfragen stellen. Der Real Case soll zeigen, dass ihr mit kurzer Vorbereitungszeit in der Lage seid, technisches und wirtschaftliches Know-How zu verknüpfen, anzuwenden und zuletzt verständlich zu präsentieren.

Final tips from Sebastian and Daniel
Abschließende Tipps von Sebastian und Daniel

- **The Cost Event is a team event, so act as such. Ideally, the person who designed a part should also prepare the cost report for it, since she or he knows the part best and has already thought about the manufacturing process during the design.**
- **Bringing spare parts as visual objects is a plus, but you are responsible for bringing them to the bay, as well as the necessary shelves. Under no circumstances should benches or similar items be carried from the Marquee to the Cost Bays.**
- **Be prepared to also unscrew covers or the wheels of the vehicle to reveal the parts underneath.**

- **Das Cost Event ist ein Teamevent, also tretet als solches auf. Die Person, welche ein Bauteil konstruiert hat, sollte im Idealfall auch den Cost Report dafür vorbereiten, da sie sich am besten mit dem Bauteil auskennt und bei der Konstruktion schon Gedanken über den Fertigungsprozess gemacht hat.**
- **Ersatzteile als Anschauungsobjekte mitzubringen ist ein Pluspunkt, allerdings seid ihr selbst dafür verantwortlich, diese in die Bay zu bringen, ebenso wie die dafür nötigen Ablagen. Auf keinen Fall sollten Bänke oder ähnliches aus der Marquee in die Cost Bays getragen werden.**
- **Seid bereit, auch Abdeckungen oder die Räder des Fahrzeugs abzuschrauben, um die darunterliegenden Teile sichtbar zu machen.**

How to date a Scruti @ FSG – successfully

Written by Sarah Battige

Dear Formula Student Team,

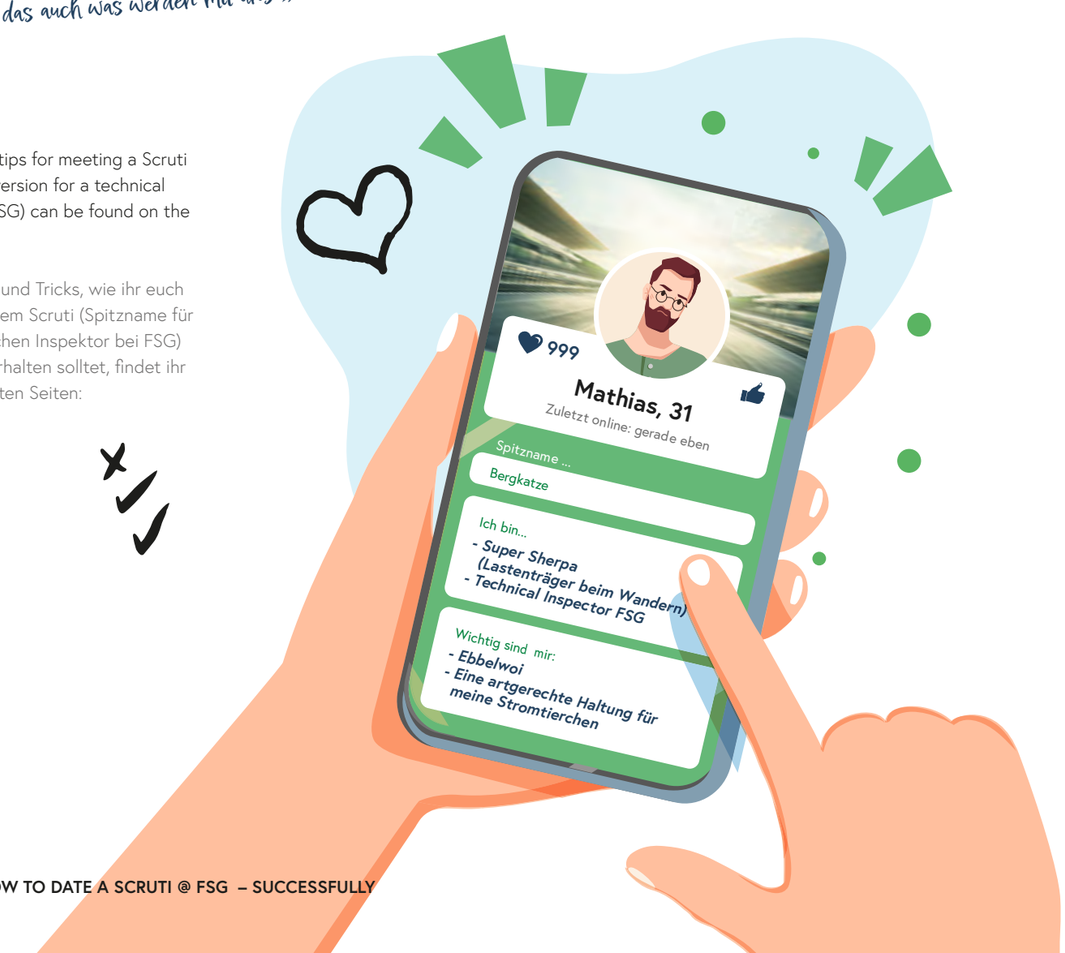
I can't wait to see you soon at the technical inspection of your car. To secure that our date doesn't end in disaster, I want to get the feeling that you're looking forward to meeting me just as much. That said, as with any good date, preparation is everything. Nevertheless, please do not learn your introduction text by heart, stay authentic and relaxed
– then it can be a match with us ;).

Liebes Formula Student Team,

Ich kann es kaum abwarten, dass wir uns bald bei der technischen Inspektion eures Boliden sehen werden. Damit unser Aufeinandertreffen jedoch nicht in einem Desaster endet, möchte ich das Gefühl bekommen, dass ihr euch ebenso auf mich freut. Das heißt, wie bei jedem guten Date gilt: Vorbereitung ist alles. Dennoch lernt euren Vorstellungstext bitte nicht auswendig, bleibt weiterhin authentisch und entspannt
– dann kann das auch was werden mit uns ;)

More general tips for meeting a Scruti (abbreviated version for a technical inspector at FSG) can be found on the next pages.

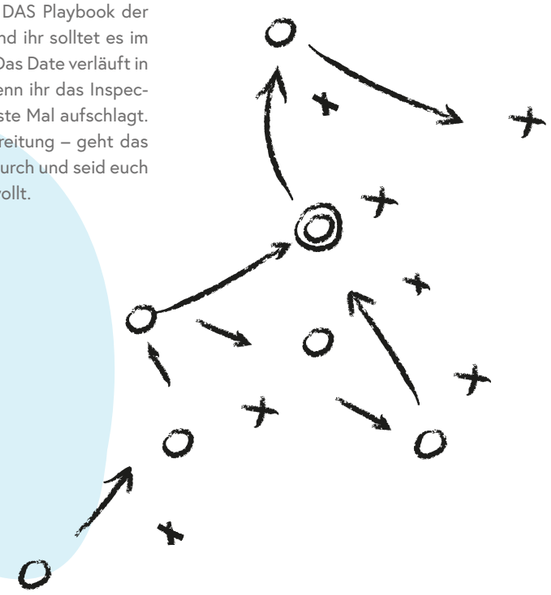
Weitere Tipps und Tricks, wie ihr euch artgerecht einem Scruti (Spitzname für einen technischen Inspektor bei FSG) gegenüber verhalten solltet, findet ihr auf den nächsten Seiten:



1.

Our favorite playbook
The Inspection Sheet is THE playbook of technical inspection and is best recited by you in your sleep. The date ends usually not successfully when you open the Inspection Sheet for the first time on site. So this is where preparation counts - go through the Inspection Sheet beforehand and be sure of what you want to tell.

Unser liebstes Playbook
Das Inspection Sheet ist DAS Playbook der technischen Inspektion und ihr solltet es im Schlaf rezitieren können. Das Date verläuft in der Regel ergebnislos, wenn ihr das Inspection Sheet vor Ort das erste Mal aufschlagt. Also hier zählt die Vorbereitung – geht das Inspection Sheet vorher durch und seid euch sicher, was ihr erzählen wollt.



2.

Safety first - with a bright TSAL and a clean pedal box.
Technical inspectors like things clean and shiny - so scrub and polish your TSAL (Tractive System Active Light) so you can make an impression! When it comes to the nitty gritty, the tech inspector also likes a clean pedal box. To make it happen at all, the area should be easily accessible. Furthermore you should also make sure that both springs can be unmounted.

Sicherheit geht vor – mit einem hell leuchtenden TSAL und einer sauberen Pedalbox
Technische Inspektoren haben es gerne hell und sauber – also schrubbt und poliert euer TSAL (Tractive System Active Light), sodass ihr Eindruck schinden könnt! Wenn es ans Eingemachte geht, freut sich der Technische Inspector auch über eine saubere Pedalbox. Damit es überhaupt so weit kommt, sollte der Bereich einfach zugänglich und beide Federn lösbar sein.

3.

Keep it simple - also with the charger
Technical inspectors are easily overwhelmed with many knobs and buttons on the charger. Save yourself the work and keep it to the most necessary controls. In a nutshell that means: be aware that inspectors like KISS. Keep It Simple and Stupid, both in the technical solution and in explaining it.
(By the way, this tip can be applied to all components, not only to the charger).

Weniger ist mehr – auch beim Ladegerät
Mit komplizierten Ladegeräten können technische Inspektoren nicht umgehen. Erspart Euch die Arbeit und belasst es bei den nötigsten Knöpfen. Bedenkt also immer, dass technische Inspektoren es gerne einfach mögen: Sowohl bei der technischen Lösung als auch beim Erklären.
(Dieser Tipp lässt sich übrigens auf alle Bauteile anwenden, nicht nur auf das Ladegerät).

4.

Tolerance - especially in manufacturing
A popular capability! A technical inspector is a fan of tolerance, because in contrast to CAD, there are manufacturing tolerances in real life. It is said that there have been teams that had a not enough ground clearance and still had to trim the excessive rear wing end plates.

Toleranz – besonders bei der Fertigung
Eine beliebte Eigenschaft! Ein Technischer Inspector ist Fan von Toleranz, denn im Gegensatz zum CAD gibt's im echten Leben Fertigungstoleranzen. Es soll schon Teams gegeben haben, die den Heckflügel zurechtdremeln mussten, obwohl die Bodenfreiheit schon zu tief war.

5.

The outer appearance is still decisive
Covering the whole car with tape neither saves weight nor cools the car better. Build a car that can withstand the rain test without tape.
And please, please be precise with the car number and name of the university! This way you can not only make a good first impression on us, but also score points in the long run. Besides, the weight that you have saved according to our lap time calculation with a too small start number or too small Uni lettering only brings a gain of approx. 0.032 points. Obviously, it is not worth risking the 20 point penalty per Dynamic Event.

Das Äußere zählt eben doch
Das ganze Auto mit Klebeband zuzukleben bringt weder Gewichtsvorteil noch kühlt es besser. Baut ein Auto, dass auch ohne Klebeband einen Rain Test übersteht.
Und bitte, bitte arbeitet präzise bei Fahrzeugnummer und Name der Universität! So könnt ihr nicht nur einen guten ersten Eindruck bei uns hinterlassen, sondern punktet auch nachhaltig. Außerdem bringt das Gewicht, dass ihr gemäß unserer Rundenzeitberechnung mit einer zu kleinen Startnummer oder zu kleinem Uni Schriftzug gespart habt, lediglich einen Gewinn von ca. 0.032 Punkten. Augenscheinlich lohnt es sich somit nicht die 20 Punkte Penalty pro Dynamic Event zu riskieren.

Summary:
In the technical inspection (scrutineering) you can't win any points, but you can lose a lot of points and time. "Keep it simple and stupid" and explain it to the Scrutis in a way that even your grandma could understand. And a general recommendation: avoid long discussions with them! If we find pleasure for it, it will only take longer and the date might end in a monologue.

So, if you follow these general tips and your car is also technically well designed and built, scrutineering will be a breeze.

Bei der technischen Inspektion (Scrutineering) könnt ihr keine Punkte gewinnen, aber viele Punkte und Zeit verlieren. „Keep it simple and stupid" und erklärt es uns Scrutis so, dass auch eure Oma es auch verstehen könnte. Und generell zu empfehlen: Vermeidet lange Diskussionen mit uns! Wenn wir auf den Geschmack kommen, dauert es nur noch länger und das Date könnte in einem Monolog enden.

Wenn ihr also diese allgemeinen Tipps befolgt und euer Auto auch technisch gut konstruiert und gebaut ist, wird die technische Abnahme ein Kinderspiel sein.

Lessons learned – the main tipps
for a successful date with a FSG Scruti:
. Know your inspection sheet by heart
. Don't start a discussion
. Make your TSAL shine
. Keep it simple

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The new Team Profiles

Written by Jennifer Stratmann & Fabian Maknapp

As an international design competition for students, Formula Student is characterised by its variety. Despite a comprehensive set of rules, the teams have creative freedom in the design and construction of their racing cars. This allows them to bring in their own ideas and conceptions and thus produce a unique car. The different interpretations mean that an impressive diversity can be seen on the race track.

Our tip: On the large display boards along the race track, you can use the car numbers to follow in real time which team from which university is currently on the track. You can also follow the timing online *https://tk.formulastudent.de*. This way you won't miss a single moment and can directly time the events.

On the following pages you can learn more about the individual vehicles and the associated teams. We have completely revised the team profiles this year to present you with the most relevant information at a glance. To help you navigate through the new team profiles, take a look at the following example with the corresponding explanations. This way you can make the most of the information provided by the participating teams.

Als internationaler Konstruktionswettbewerb für Studierende, zeichnet sich die Formula Student durch ihre Vielfalt aus. Trotz eines umfangreichen Regelwerks haben die Teams gestalterischen Freiraum im Design und bei der Konstruktion ihrer Rennwagen. Dadurch können sie ihre eigenen Ideen und Vorstellungen einbringen und so ein einzigartiges Auto fertigen. Die unterschiedlichen Interpretationen führen dazu, dass auf der Rennstrecke eine beeindruckende Diversität zu sehen ist.

Unser Tipp: Auf den großen Anzeigetafeln entlang der Rennstrecke können Sie mithilfe der Fahrzeugnummern in Echtzeit verfolgen, welches Team von welcher Universität gerade auf der Strecke unterwegs ist. Ebenso können Sie die Zeitmessung online verfolgen *https://tk.formulastudent.de*. So verpassen Sie keinen Moment und können das Geschehen direkt zeitlich einordnen.

Auf den folgenden Seiten erfahren Sie mehr über die einzelnen Fahrzeuge und die dazugehörigen Teams. Wir haben die Teamprofile in diesem Jahr vollständig überarbeitet, um Ihnen die relevantesten Informationen auf einem Blick zu präsentieren. Um Ihnen die Navigation durch die neuen Teamprofile zu erleichtern, werfen Sie einen Blick auf das folgende Beispiel mit den entsprechenden Erklärungen. So können Sie das Beste aus den wertvollen Einblicken ziehen, die von den teilnehmenden Teams geteilt werden.

Facts/Fakten

City/Stadt

Name of the university/
Name der Universität

Boxes (l. t. r.)
Boxen (v. l. n. r.)
Car: car number
Pit: 0-A
WRL: Rank on the World Ranking List (see fs-world.org) / Rang auf der Weltrangliste (siehe fs-world.org)
Country / Land

Team name

Description of the team /
Beschreibung des Teams

QR-Code

While we focus on the most important facts in the magazine, we invite you to explore more details on our newly updated online team profiles. Simply scan the QR code for additional data (such as what material the monocoque is made of or what suspension has been fitted). This information will give you a deeper understanding of each team. / Während wir uns im Magazin auf die wichtigsten Fakten konzentrieren, laden wir Sie ein, weitere Details auf unseren neu aktualisierten Online-Teamprofilen zu erkunden. Scannen Sie einfach den QR Code ein und erhalten Sie eine Fülle von zusätzlichen Daten (wie zum Beispiel aus welchem Material das Monocoque ist oder welches Fahrwerk verbaut wurde). Diese Informationen werden Ihnen ein tieferes Verständnis für jedes Teams vermitteln.

Hockenheim

University: University of Formula Racing

Car 999 | Pit 0-A | WRL 0 | Germany

Formula Student Germany - Racing Team

We are the FSG Racing Team. We have been the home racing team at the Hockenheimring since 2006. With over 400 members, we are probably also the largest team at the event. We started by building an combustion racing car. Over the years, however, we have developed a new design concept and are proud to present an electric car with autonomous function today.

253 kg

weight:
Weight of the car including one driver with 68 kg / Gewicht des Auto **inklusive** eines Fahrers mit 68 kg

100 kW / rpm

CV: rpm:
maximal number of revolutions of the engine / Maximale Drehzahl des Motors

EV: kW:
Sum of the power of all motors / Summe der Leistung aller Motoren

6.9 cylinder / kWh

CV: cylinder:
Number of cylinders in the engine / Anzahl der Zylinder im Motor

EV: kWh:
capacity of the accumulator / Kapazität des Akkumulators

2006 first event

first event:
First season of the team in this class on a WRL ranked event / Erste Saison des Teams in dieser Klasse auf einem Weltranglisten Event

16 participations in class

participations:
Number of participations at FSG in this class / Anzahl der Teilnahmen an FSG in dieser Klasse

Colour Code / Farbcode

- Combustion with driverless components / Verbrenner mit autonomen Komponenten
- Combustion / Verbrenner
- Electric with driveless components / Elektisch mit autonomen Komponenten
- Electric / Elektrisch

Abkürzungen / Abkürzungen:

CV: Combustion Vehicle
EV: Electric Vehicle
DV: Driverless Vehicle

rpm: Rotations per minute
kW: Kilowatt
kWh: Kilowatt-hour / Kilowattstunde

Participating Formula Student Combustion TEAMS 2023

Teams

https://fsg.one/cv23

Car	City/University	Country	Pit	Page
213	Gdańsk TU	Poland	T-63	98
216	Castellón de la Plana UJI	Spain	T-65	97
221	Bari PT	Italy	38-C	97
225	Manresa EPSEM	Spain	T-62	101
229	Stuttgart U	Germany	23-B	104
232	Iasi TU	Romania	T-57	99
233	Shanghai Tongji U	China	29-C	103
249	Krefeld HSNR	Germany	35-C	99
250	Lübeck TH	Germany	40-C	100
254	Vellore VIT	India	T-50	105
270	Coburg UAS	Germany	31-C	97
278	Tampere UAS	Finland	T-61	104
284	Hannover UAS	Germany	T-56	98
288	Oulu U	Finland	26-C	103

Car	City/University	Country	Pit	Page
289	Ostrava VŠB-TU	Czech Republic	37-C	102
312	Puerto Real UCA	Spain	T-53	103
322	Napoli UNINA	Italy	T-58	102
323	Stralsund UAS	Germany	43-B	104
326	Dortmund UAS	Germany	T-51	98
330	Akron U	United States	T-52	96
338	Warsaw UT	Poland	34-C	105
364	Málaga UMA	Spain	T-54	101
365	Odessa ONPU	Ukraine	T-59	102
373	Leganés UC3M	Spain	T-64	100
378	Levallois-Perret ESTACA	France	T-55	100
395	Valéncia UPV	Spain	28-C	105
396	Móstoles URJC	Spain	T-60	101
399	Karlsruhe UAS	Germany	32-C	99

STATUS/STAND: 20.07.2023

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Participating Formula Student Electric TEAMS 2023

Teams

https://fsg.one/ev23

Car	City/University	Country	Pit	Page
13	Corvallis OSU	United States	37-A	109
14	Budapest TU	Hungary	09-A	109
17	Pune PCCOE	India	06-C	124
20	Magdeburg OvGU	Germany	28-A	120
21	Moscow BMSTU	Russia	44-C	121
22	Stralsund UAS	Germany	43-A	125
23	Hannover U	Germany	34-A	115
24	Darmstadt TU	Germany	14-A	110
25	Athens TU	Greece	16-C	106
26	Stuttgart U	Germany	23-A	126
28	Kassel U	Germany	29-B	118
31	München TU	Germany	04-A	122
32	Porto U	Portugal	07-B	123
33	Zürich ETH	Switzerland	12-B	129
34	Ingolstadt UAS	Germany	40-B	116
35	Wolfenbüttel UAS Ostfalia	Germany	06-A	129
40	Eindhoven TU	Netherlands	06-B	112
41	Wien TU	Austria	17-B	128
42	Ulm UAS	Germany	20-B	127
43	Konstanz UAS	Germany	38-A	118
44	Deggendorf IT	Germany	26-A	110
48	Bochum U	Germany	25-B	108
49	Erlangen U	Germany	38-B	112
50	Lisboa IST	Portugal	43-C	119
51	Sevilla U	Spain	46-B	125
53	Lemgo TH OWL	Germany	31-A	119
54	Barcelona UPC	Spain	46-A	107
59	Dresden TU	Germany	22-A	111
60	Weingarten UAS	Germany	17-C	128
62	Regensburg OTH	Germany	34-B	124
63	Trondheim NTNU	Norway	29-A	127
65	Pisa U	Italy	22-B	123
66	Weihai HIT	China	37-B	128
68	Hsinchu NTHU	Taiwan	10-A	116
71	Stockholm KTH	Sweden	16-A	125
72	Bremen U	Germany	23-C	108
74	Brno TU	Czech Republic	41-A	109
76	Freiberg TU	Germany	16-B	113
77	Stuttgart DHBW	Germany	35-A	126
78	Hamburg TU	Germany	44-A	114
79	Barcelona EEBE UPC	Spain	10-B	107
85	Delft TU	Netherlands	19-A	110
88	Montréal ETS	Canada	31-B	121
90	Milano PT	Italy	32-A	120
94	Esslingen UAS	Germany	22-C	113
95	Göteborg Chalmers	Sweden	12-C	114
97	Schweinfurt UAS	Germany	20-A	124
98	Helsinki UAS	Finland	04-B	115
99	Aachen RWTH	Germany	07-A	106
101	Mannheim DHBW	Germany	19-B	120
107	Innsbruck U	Austria	14-B	117
110	Augsburg UAS	Germany	17-A	107
111	Trento U	Italy	25-C	127
113	München UAS	Germany	04-C	122
115	Glasgow U Strath	United Kingdom	41-B	113
117	New Delhi IIT	India	25-A	122
120	Karlsruhe KIT	Germany	09-B	117
122	Diepholz UAS	Germany	26-B	111
123	Amberg OTH	Germany	07-C	106
124	Tallinn TU UAS	Estonia	19-C	126
127	Lausanne EPFL	Switzerland	28-B	118
131	Berlin TU	Germany	10-C	108
161	Göttingen HAWK	Germany	20-C	114
164	Kaiserslautern RPTU	Germany	12-A	117
167	Osnabrück UAS	Germany	09-C	123
169	Ljubljana U	Slovenia	44-B	119
170	Mittweida UAS	Germany	35-B	121
171	Ilmenau TU	Germany	32-B	116
172	Dortmund TU	Germany	40-A	111
196	Hamburg UAS	Germany	14-C	115
800	Enschede U Twente	Netherlands		112

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Formula Student
Team profiles

27 nations
2859 students

24 teams Combustion
4 teams Driverless Combustions

31 teams Electric
41 teams Driverless Electric

Akron
University of Akron

Car 330 | Pit T-52 | WRL 58 | United States

Zips Racing

Zips Racing is a part of The University of Akron and the team was created in 1989. The team prioritizes having a reliable car that is based around good handling characteristics and has good drivability. The latest car from the team is named ZR22 and features Goodyear 13" tires, carbon fiber half monocoque, full aero package with automatic DRS, and features a Yamaha WR450F engine. Zips Racing is here to design together, build together, and race together!

245 kg | **1100** rpm | **1** cylinder | **1992** first event | **7** participations in class

Bari
Polytechnic University of Bari

Car 221 | Pit 38-C | WRL 445 | Italy

Poliba Corse

We are Poliba Corse, the Formula Student team from the Polytechnic of Bari. We believe in the strength of our history and in the force of southern Italy, thus we've worked with our sponsors since 2006 to enhance our territory resources. Our mission is to pass on experience to student members, which is why the team is constantly evolving. Hundreds of meetings and hours of work made possible our rebranding and the construction of the PC7-Finale, the latest Poliba Corse car. See you on track!

338 kg | **11500** rpm | **4** cylinder | **2008** first event | **4** participations in class

Castellón de la Plana
Universitat Jaume I

Car 216 | Pit T-65 | WRL 467 | Spain

UJI Motorsport FS Team

We are the UJI Motorsport team, from Castellón (Spain) and we are very excited to participate again in FSG. This year we have been designing and building our fifth single-seater called UFS05. Our team is composed by fifty people and together we have put our dedication, effort and work so that we were able to bring this car to a reality. Applying last seasons experience and knowledge, we have been able to improve every single department that makes posible the execution of this car.

328 kg | **8500** rpm | **2** cylinder | **2016** first event | **1** participations in class

Coburg
University of Applied Sciences Coburg

Car 270 | Pit 31-C | WRL 144 | Germany

CAT-Racing

The snow leopard ("Schneeleopard") is a species of large cat in the genus Panthera of the family Felidae. The species is native to the mountain ranges of Central and South Asia. After 16 years we built our anniversary car, the C-23 Schneeleopard. This year's biggest changes and features besides a new monocoque are a rear axle steering and a heave damper system. On this vehicle, we use jet ignition and an intake manifold length adjustment in our powertrain. We look forward to an exciting season!

243 kg | **10300** rpm | **4** cylinder | **2008** first event | **14** participations in class

Dortmund

University of Applied Sciences Dortmund

Car 326 | Pit T-51 | Germany

FH-Dortmund Race-Ing.

The Race-Ing. Team of UAS Dortmund is a group of engaged students of different fields of study. Beside our study we develop racecars to take part in the Formula Student competition. The project should give us the possibility to apply theoretical knowledge from the studies practically. We set ourselves the target to produce a racecar with high raceing-performance and durability. We wish all participants, officials, visitors and all red shirts an amazing and above all an accident free competition.

301 kg | **11000** rpm | **4** cylinder | **2007** first event | **6** participations in class

Gdańsk

Gdańsk University of Technology

Car 213 | Pit T-63 | WRL 349 | Poland

PGRacing Team

The first Formula Student team in northern Poland returns with PGR-07. Over 70 people have been working hard over the last months to prepare for the 2023 season. We are a less experienced team, but we put our soul and heart into it, thanks to which we can compete with the best. This year's car is an improvement of the revolutionary PGR-06 car from 2022. Even faster, even lighter, still making a huge impression.

283 kg | **9786** rpm | **3** cylinder | **2018** first event | **1** participations in class

Hannover

University of Applied Sciences Hannover

Car 284 | Pit T-56 | WRL 266 | Germany

Campus Motorsport Hannover

Teamwork, fun and racing! That´s what you get when you are part of Campus Motorsport Hannover. Since 2007 we are building high performance race cars and are highly committed to being at the front. This year, the Pegasus 2023 will be our last combustion vehicle, which makes FSG very special for us. In 2009 FSG was our first Formula Student event ever. Since then we contributed our ideas and expand our knowledge. That´s why we hope, we can end our CV history on a high with FSG together.

288 kg | **6800** rpm | **1** cylinder | **2009** first event | **5** participations in class

Iasi

Technical University of Iasi

Car 232 | Pit T-57 | WRL 560 | Romania

T.U.Iasi Racing Team

After 13 years participating in Formula Student Events, we proudly present our 8th racecar which will compete this year in 3 Events. With help of our sponsors we finished the racecar in time for test drives in order to prepare our drivers with new powertrain, vehicle dynamics and driver controls. The TR23 is a turning point in terms of general concept, design and manufacturing while most of the team members are beginners in the Formula Student project.

320 kg | **9000** rpm | **2** cylinder | **2012** first event | participations in class

Karlsruhe

University of Applied Sciences Karlsruhe

Car 399 | Pit 32-C | WRL 21 | Germany

High Speed Karlsruhe

High Speed Karlsruhe is entering its 17th season in the Formula Student combustion competition. Around 80 team members are working together to build the new race car called F-117, which has a monocoque with a new layup and a modified aero package including sidepods. The F-117 features a shark fin, a revised cooling system and a removable hybrid system. Team members program and operate CNC machines, laminate the CFRP parts and assemble the electronic boards themselve.

230 kg | **9000** rpm | **1** cylinder | **2007** first event | **15** participations in class

Krefeld

Hochschule Niederrhein

Car 249 | Pit 35-C | WRL 244 | Germany

HSNR Racing

Founded in 2012, HSNR Racing represents the UAS Niederrhein from Krefeld, Germany. We are proud to present our latest racecar, the RS-23C. While developing the RS-23C, we set ourselves some main goals. Reliability, light weight and great performance are just the tip of the iceberg. We are confident to improve results at FSG from our previous participation last year. The team has learned a lot since then and is ready to give it our all. #FORTYNINE

238 kg | **9300** rpm | **1** cylinder | **2012** first event | **4** participations in class

Leganés

University Carlos III of Madrid

Car 373 | Pit T-64 | WRL 462 | Spain

MAD Formula Team

MAD Formula Team is the Formula Student team from Carlos III de Madrid University, in Leganés, Spain. Composed of 81 students, mostly from engineering disciplines, we base our approach to race car design on three core concepts: resource management, a clear design approach based on understanding first principles, and continuously learning from previous mistakes.

300 kg **10200** rpm **4** cylinder **2016** first event **2** participations in class

Levallois-Perret

ESTACA - Paris-Saclay

Car 378 | Pit T-55 | France

Estaca Formula Team

EC-04, is ESTACA Formula team's 4th car. For this single seater a lot of effort have been put in the manufacturing quality, with one goal in mind: be as close as possible from what we have originally designed. Be it the carbon fibrer reinforced part, chassis, suspension, harness … all of those manufacturing process have been re-thinked and largely improved compared to our previous car. We try our best to create sensation within our budget and hope that it is a shared feeling.

277 kg **11000** rpm **3** cylinder **2013** first event

Lübeck

Technische Hochschule Lübeck

Car 250 | Pit 40-C | WRL 508 | Germany

Seagulls Luebeck

We, the Seagulls Luebeck, are a young Formula Student team from northern Germany. With nearly 50 Seagulls next to our fellow workshop-leader Bolle our team grows and grows. With this year's car, we present the SG04. Taking our last car and working out all the vulnerabilities, we were able to create a new milestone in seagulls history and are celebrating our five years anniversary. With a new aero-design, tighter frame, optimized oil pan and many more improvements, we are ready to go on track.

290 kg **9000** rpm **4** cylinder **2019** first event **2** participations in class

Málaga

Málaga UMA

Car 364 | Pit T-54 | WRL 557 | Spain

Malaga Racing Team

Málaga Racing Team (MART), a young team but with more desire than any other. From southern Europe, struggling to compete with the best teams in the world. We have competed on 3 opportunities, FSS21, FSN22 and FSS22. Focusing on the reliability of the car, we have managed to finish the 3 Endurance events, highlighting the 2 podiums places last season. We face this season with more motivation, looking to improve the performance of our car and continue to grow as a team. See you on the track!

300 kg **10000** rpm **4** cylinder **2018** first event

Manresa

Escola Politècnica Superior d'Enginyeria de Manresa

Car 225 | Pit T-62 | WRL 455 | Spain

Dynamics UPC Manresa

Dynamics UPC Manresa is an 8 year old team formed by students from Escola Politècnica Superior d'Enginyers de Manresa who are very proud to be a part of FSG for the second time. With its foundation back in 2015 and a total of 7 combustion vehicles built ever since, it is a young team fueled by passion and will to improve. The biggest achievement for the team has been a podium back in FSN 2018 during the DYN-03's tremendous performance.This will to improve inspires revolutionary projects.

335 kg **9500** rpm **1** cylinder **2016** first event **1** participations in class

Móstoles

Universidad Rey Juan Carlos

Car 396 | Pit T-60 | WRL 397 | Spain

U Motorsport

Ü Motorsport is the Formula Student team of the Rey Juan Carlos University, founded in 2016. This season our team developed the seventh prototype, UM07, which incorporates an autonomous system. Among the newest enhancements, noteworthy the development of the monocoque and a redesigned conical-spinlane-intake which achieves a remarkable power and torque increase, as well as new aero package and 3D printed uprights and bellcranks.

315 kg **12000** rpm **4** cylinder **2016** first event

Napoli

Università degli Studi di Napoli Federico II

Car 322 | Pit T-58 | WRL 208 | Italy

UniNa Corse - Squadra Corse "Federico II"

UniNa Corse, the racing team of Federico II University of Naples, is embarking on an exciting journey this year. For the first time in our history, we're participating in three events with a fully re-designed car, focusing on advancements in both mechanical and Driverless technology. Our mission is to build upon our previous successes in 2022 season and push the boundaries of technological innovation, embracing the advancements in autonomous driving.

320 kg | **11000** rpm | **4** cylinder | **2015** first event | **2** participations in class

Odessa

Odessa Polytechnic National State University

Car 365 | Pit T-59 | WRL 523 | Ukraine

Formula Student ONPU

We are the first Ukrainian Formula Student team, pioneers in our nation's pursuit of engineering excellence. With unwavering determination and a relentless drive for innovation, we strive to inspire a culture of technological brilliance in Ukraine. Through cutting-edge technologies, collaboration, and nurturing the next generation of visionary engineers, we aim to make a lasting impact and propel our nation towards a brighter, more innovative future.

327 kg | **7500** rpm | **2** cylinder | **2013** first event

Ostrava

VŠB - Technical University of Ostrava

Car 289 | Pit 37-C | WRL 90 | Czech Republic

Formula TU Ostrava

At Formula TU Ostrava, we embrace the spirit of competition and the thrill of the race, constantly pushing the boundaries of automotive engineering to design and build a high-performance race car. We have dedicated extensive time and effort to developing an exceptional hybrid Formula Student car that takes innovation to the next level. Our groundbreaking creation combines a Yamaha FZ6 engine on the rear axle with our pioneering hybrid system, featuring two electromotors powering the front axle.

274 kg | **12000** rpm | **4** cylinder | **2015** first event

Oulu

University of Oulu

Car 288 | Pit 26-C | WRL 163 | Finland

Formula Student Oulu

Formula Student Oulu is a team of 60 students from University of Oulu. The team was founded in 2013 making this the ten year anniversary. This year's car, M04, is the culmination of the experience and skills gathered during the team's tenure thus far. The design process with this car focused on maximizing the power-to-weight ratio with the lightest frame in the team's history. That was achieved while also improving handling with innovative solutions in aero and suspension. Oppiipaha!

418 kg | **8500** rpm | **2** cylinder | **2019** first event

Puerto Real

University of Cadiz

Car 312 | Pit T-53 | WRL 567 | Spain

Formula Gades

Founded by students of the University of Cadiz in 2017, Formula Gades built the fourth car for the formula student competition. Based on our experience gained in previous seasons, around 50 students take part in this project focusing on design, manufacture and test our new combustion single seater, the G22EVO. This season we want to create a breaking point and finally consolidate our team and we are going to put all our effort to make Formula Gades a strong one in the Formula Student family.

313 kg | **12500** rpm | **4** cylinder | **2018** first event | **1** participations in class

Shanghai

Tongji University

Car 233 | Pit 29-C | WRL 13 | China

TJU Racing

TJU Racing Team is a non-commercial formula racing team founded in 2007. In FSAE Japan 2016, TJU Racing took the 1st place in Acceleration, 2nd in Skid-pad and 3rd in Suspension Design. Since FSAE was first introduced into China in 2010, TJU Racing team has been playing an important role as the pioneer, promoting and also helping develop the competition. Since then, FSAE China has been held for 12 times. In FSAE China 2016 and 2019, we've won the championship twice.

278 kg | **11000** rpm | **3** cylinder | **2009** first event | **1** participations in class

Stralsund

University of Applied Sciences Stralsund

Car 323 | Pit 43-B | WRL 200 | Germany

Baltic Racing

Baltic Racing is now participating in its 24th season. Since 1999 the first German team has been manufacturing combustion race cars. As this will be the last season of combustion cars, we wanted to design one last combustion car. A car that will call the rich history of our team to mind and serve the team for many more years while transitioning into the next exciting chapter with electric vehicles. To achieve this, a small team set its goal to leave the combustion competition with a final bang.

279 kg | **9000** rpm | **3** cylinder | **2001** first event | **15** participations in class

Stuttgart

University of Stuttgart

Car 229 | Pit 23-B | WRL 59 | Germany

Rennteam Uni Stuttgart

Who are we? The Rennteam Uni Stuttgart was founded in 2005 and has since built up an impressive history in Formula Student. What are we planning to do this season? Besides the switch to a new tire size we developed a plug and play hybrid system, which marks a big step in our history. Since it will be the last year combustion vehicles are allowed to participate at FSG we tried to maximize our performance on track. But trust us, it won't be the last time you will see the Rennteam in action. ;)

262 kg | **10500** rpm | **4** cylinder | **2006** first event | **16** participations in class

Tampere

University of Applied Sciences Tampere

Car 278 | Pit T-61 | WRL 403 | Finland

Tampere Formula Student

Tampere Formula Student is entering its 15th competition season this year with the completely new TFS23. The whole car was designed from the ground up around our first CFRP monocoque with new suspension geometry, reinvented aero package, modular ICE packaging and improved electronics. Our team is mostly known for our team spirit and laid back attitude. However, with the massive technical step forward, we also aim to take our performance to the next level and be more competitive in the future.

246 kg | **7000** rpm | **1** cylinder | **2008** first event | **5** participations in class

Valéncia

Universitat Politécnica de Valéncia

Car 395 | Pit 28-C | WRL 3 | Spain

FSUPV Team

We, the FSUPV Team, are a 10th-year team that aims to make full use of the car through a strong philosophy based on setting self-challenging goals that demand efficient team and resource management. This need for continuous improvement kept us as a reference in the combustion class competitions throughout these ten years. Embracing the challenge of building an autonomous racing system while keeping track of performance, our main goal for the season is to be Top 1 in every competition.

280 kg | **11400** rpm | **4** cylinder | **2014** first event | **8** participations in class

Vellore

VIT University - Vellore

Car 254 | Pit T-50 | WRL 339 | India

Pravega Racing

Pravega is the Sanskrit word for acceleration. The team was conceived in the year 2009, everything that followed has been an amalgamation of hard work, perseverance and eventually - glory. Year after year, the team has maintained a consistent growth rate which led to it being crowned the best team in India in the year 2017. PRV-23 is the 12th edition of our Formula Style Racecar which was designed and manufactured with an objective to achieve improved reliability while keeping it light.

258 kg | **9000** rpm | **1** cylinder | **2010** first event | **5** participations in class

Warsaw

Warsaw University of Technology

Car 338 | Pit 34-C | WRL 185 | Poland

WUT Racing Team

WUT Racing, the Formula Student team from Warsaw University of Technology, proudly presents its fourth racecar, the WUT-4. With completely redesigned monocoque, improved aerodynamics package and several other performance-enhancing changes compared to its predecessor, it represents the combined effort of all our team members and a significant step forward in our engineering process. We are very excited about our first start in FSG and we are hoping to make history!

270 kg | **11000** rpm | **4** cylinder | **2010** first event

Aachen

RWTH Aachen University

Car 99 | Pit 07-A | WRL 24 | Germany

Ecurie Aix Formula Student Team RWTH Aachen e.V.

Ecurie Aix is the second Formula Student Team to be founded in Germany. Since 1999, we have designed and manufactured 20 prototype racecars. We were always at the forefront of new rule changes, and therefore, since last year, we are only building one racecar combining the electrical and driverless categories. The eax02 is the fastest and lightest racecar we have ever built and the latest evolution in this new era of merge racecars to be raced at three Formula Student Events around Europe in 2023.

230 kg | **141** kW | **6.8** kWh | **2010** first event | **9** participations in class

Amberg

Ostbayerische Technische Hochschule Amberg-Weiden (OTH)

Car 123 | Pit 07-C | WRL 90 | Germany

Running Snail Racing Team

Founded in 2004, the Running Snail Racing Team of the UAS Amberg-Weiden will compete in this year's competitions with their 10th electric race car, the RS23. In 2023, the team's motto is 'Evolution instead of Revolution'. Due to that, adjustments and improvements were made compared to last year's racing car, the RS22, in order to focus on the cars' reliability. We are looking forward to a competitive season and surpass last year's results.

267 kg | **141** kW | **8.2** kWh | **2013** first event | **9** participations in class

Athens

National Technical University of Athens

Car 25 | Pit 16-C | WRL 27 | Greece

Prom Racing

Get ready for the awe-inspiring P23 by NTU Athens' Prom Racing—a groundbreaking single-motor electric FS race car for the FSG challenge. It's our first foray into driverless EVs, combining unmatched speed, efficiency, and reliability. With a lighter chassis, regenerative braking, and our passion for innovation, the Greek white racing car will dominate the track. Brace yourself for an excellent display of motion!

265 kg | **120** kW | **9.1** kWh | **2021** first event | **1** participations in class

Augsburg

Augsburg University of Applied Sciences

Car 110 | Pit 17-A | WRL 50 | Germany

StarkStrom Augsburg

After the success of the previous season, it was of course part of this year's goals of StarkStrom Augsburg e.V. to build on this. However - as a smaller team - you don't always have the resources to reinvent the wheel every year. Accordingly, the main goal of the 2023 season is to close existing knowledge gaps, eliminate known flaws of the car and thus continue to do what was proven last season as the own strength: Building a reliable racecar and being prepared for every possible situation.

278 kg | **140** kW | **7.8** kWh | **2012** first event | **8** participations in class

Barcelona

PT University of Catalonia - Engineering School of Barcelona

Car 54 | Pit 46-A | WRL 66 | Spain

BCN eMotorsport

BCN eMotorsport is the new era of ETSEIB Motorsport, established in 2007 in Barcelona. This season, we are proud to introduce the CAT15x, the second fusion car of the team. With a great basis from last year's design, the new CAT keeps the same philosophy but improves lots of details to achieve better reliability and performance. After a year of hard work, we are excited to show the potential the CAT15x has in both manual and driverless mode.

294 kg | **218** kW | **8.2** kWh | **2012** first event | **8** participations in class

Barcelona

Barcelona EEBE UPC

Car 79 | Pit 10-B | WRL 170 | Spain

e-Tech Racing

e-Tech Racing is the Formula Student team from UPC EEBE, located in Barcelona. The team was founded in 2013 and has been consistently working on electric vehicle prototypes ever since. This year, they are proud to present their 8th prototype and are fully committed to maximizing its performance.

234 kg | **120** kW | **6.3** kWh | **2014** first event

Berlin

Technische Universität Berlin

Car 131 | Pit 10-C | WRL 118 | Germany

FaSTTUBe Electric

The FT23 is the second electric race car in FaSTTUBe's history with a fully developed aerodynamic package.The new slim packaging concept of the vehicle rear gives us maximum potential for our aerodynamic goals. Therefore, the newly designed accumulator and drivetrain are arranged in a parallel configuration, which increase the maintenance and mounting accessibility. From the start, the vehicle was developed with an autonomous system integrated into the overall concept of the FT23.

294 kg | **120** kW | **7.7** kWh | **2010** first event | **5** participations in class

Bochum

Ruhr University Bochum

Car 48 | Pit 25-B | WRL 176 | Germany

RUB Motorsport

New chapter page 2. 2023 sees us venture out on track with an electric car for the second time. The RUB23e is an evolution of its predecessor rethought from ground up. A reduction in weight along with improved manufacturing quality stand as important achievements this year. Founded on groundwork that is a tight-knight team we believe to have a competitive package. All-white and with a selection of iconic symbols from our home region the 23e resembles a visual homage to our geographical heritage.

260 kg | **109** kW | **7.3** kWh | **2022** first event | **1** participations in class

Bremen

University of Bremen

Car 72 | Pit 23-C | WRL 204 | Germany

Bremergy e.V.

From the lecture to the race track. Bremergy is the Formual Student Team from Bremen, Germany. We have been competing in the FSE since 2013 and are thus celebrating our tenth anniversary this year. Our team consists of about 55 members who worked together to realize BreMo23. With the implementation of new manufacturing processes and a changed team structure, we were able to optimize various points in the construction of the BreMo23.

315 kg | **172** kW | **48.1** kWh | **2013** first event | **4** participations in class

Brno

Technical University of Brno

Car 74 | Pit 41-A | WRL 30 | Czech Republic

TU Brno Racing

Since 2010, the TU Brno Racing team has successfully designed and built 13 Formula Student cars, 10 were powered by combustion engines. We are thrilled to present our latest achievement: the Dragon e3, third electric formula car! The construction of this remarkable vehicle was carried out by 50 talented students from 4 faculties of Brno University of Technology. With the Dragon e3, we have set our sights high, aiming to achieve the best results in the history of our team.

241 kg | **71** kW | **8** kWh | **2021** first event | participations in class

Budapest

Budapest University of Technology and Economics

Car 14 | Pit 09-A | WRL 16 | Hungary

BME Formula Racing Team (FSE)

The team was founded in 2007 at TU Budapest with the purpose of participating in the international Formula Student series. We are proud to be the pioneers of Hungary's FS teams. Since 2011 we have been the first and only team in Hungary to race in the more environmentally friendly electric category, being the leaders in constructing driverless FS cars as well. Last year we had one of our strongest season, finishing on the podium in FSG, with significant improvements to our driverless system.

256 kg | **140** kW | **7** kWh | **2012** first event | **2** participations in class

Corvallis

Oregon State University

Car 13 | Pit 37-A | WRL 41 | United States

Global-Formula-Racing (US)

We are Global Formula Racing, a collaboration between Oregon State University (USA) and DHBW Ravensburg (Germany), founded in 2009. As a fully international team, both sides collaborate on the design, manufacturing, and testing of the vehicles. This year's car, GFR23 is a complete overhaul and redesign of our established systems. This means a lot of new designs and changes that we are excited to highlight and showcase in the American and European competitions. Be sure to stop by our pit!

269 kg | **112** kW | **6.8** kWh | **2011** first event | **8** participations in class

Darmstadt

Technische Universität Darmstadt

Car 24 | Pit 14-A | WRL 83 | Germany

TU Darmstadt Racing Team e.V.

The TU Darmstadt Racing Team e.V. (DART Racing) has participated in Formula Student Germany every year since 2006. Starting with a combustion engine, DART Racing has been building a fully electric racing car since 2011 and has been developing an autonomous system since 2017. In 2023 40 students are working on the pi2023. This year's special feature is the autonomous driving using only a lidar-sensor and the design of new kinematics enabling smoother steering.

268 kg | **176** kW | **8.2** kWh | **2011** first event | **9** participations in class

Deggendorf

Deggendorf Institute of Technology

Car 44 | Pit 26-A | WRL 156 | Germany

Fast Forest

#sauguad - not just a word you hear us shout after a successful discipline, but also our motivation! The second time in our team's history, we are building a race car, that has a fully integrated DV system. Besides the integration of our autonomous system, we are focusing on an improved manufacturing process to enhance our reliability. At the end of the season, we want to be proud of our achievements and have a car, that we can say is "saugaud"!

285 kg | **128** kW | **7** kWh | **2010** first event | **8** participations in class

Delft

Delft University of Technology

Car 85 | Pit 19-A | WRL 33 | Netherlands

Formula Student Team Delft

The DUT23 is the newest car in our collection. It will be our first car capable of both human and autonomous driving. A revised aerodynamics package has been implemented, which includes active aerodynamics, a new drag reduction system design, and an overall emphasis on improving downforce around corners using cornering simulations. Our cells have undergone thorough testing to perform in every possible environment, and our self-designed motor controllers have been optimized for greater efficiency

233 kg | **140** kW | **6.8** kWh | **2011** first event | **10** participations in class

Diepholz

University of Applied Sciences Diepholz/Oldenburg/Vechta

Car 122 | Pit 26-B | WRL 198 | Germany

Deefholt Dynamics e.V.

We are Deefholt Dynamics, the racing team of the PHWT from Diepholz. We've been part of the FS-Community since 2006. The special thing about us: our car is built by a first-year team within only six months, every year. This season, 40 students joined the project with one goal: To build a competitive car one step at a time as fast as no one else can. Year after year. Among other things, the shape of the monocoque was optimised in terms of weight and dimensions.

240 kg | **120** kW | **7.8** kWh | **2010** first event | **8** participations in class

Dortmund

Technical University of Dortmund

Car 172 | Pit 40-A | WRL 229 | Germany

GET racing Dortmund e.V.

Founded in 2005, GET racing comes right from the heart of Germany's famous Ruhrgebiet, Dortmund. Located at TU Dortmund University, last year the team finished its first ever electric vehicle to compete in the Formula Student competition. For this season, we have refined our designes and built in a driverless system.

338 kg | **120** kW | **6.3** kWh | **2022** first event | **1** participations in class

Dresden

Technische Universität Dresden

Car 59 | Pit 22-A | WRL 45 | Germany

Elbflorace

Let us welcome Rose, the 15th race car of our Formula Student Team Elbflorace! This year the main focus is on reliability, through troubleshooting and improvements. We have also been able to make some changes to the previous concept, such as better packaging, a successful weight reduction, or a semi-active hydraulically decoupled suspension system. To make all this happen, we are very grateful to our hard-work members! The team and RosE look forward to seeing everyone else at Hockenheim in 2023!

239 kg | **140** kW | **7.2** kWh | **2011** first event | **11** participations in class

Eindhoven

Eindhoven University of Technology

Car 40 | Pit 06-B | WRL 4 | Netherlands

University Racing Eindhoven

University Racing Eindhoven (URE) has competed in the EV competition from 2010 onward and since 2018 in the DV competition. This year, URE will participate with their 17th car built by a team of approximately 80 students. This year, the URE17 improved the 'flip of a switch' hybrid car concept between EV and DV, making it possible that the car converts in a couple of seconds. The URE17 will compete with its new custom inverter, a full aerodynamic package, and custom Vredestein tires.

262 kg | **140** kW | **7** kWh | **2010** first event | **9** participations in class

Enschede

University of Twente

Car 800 | Netherlands

Green Team Twente - Hydrogen

Green Team Twente is a multidisciplinary team of 26 students studying in Enschede. By working full-time on one common goal, we will show the world what hydrogen is capable of and educate people about it. This year we do this by continuing our challenge to create a Formula Student car with a Hydrogen Powertrain, a project that is all about proving the concept that hydrogen vehicles are a part of the future.

hydrogen prototype

618 kg | **72** kW | **11.5** kWh

Erlangen

Friedrich-Alexander-Universität Erlangen-Nürnberg

Car 49 | Pit 38-B | WRL 139 | Germany

High-Octane Motorsports e.V.

Using our previously gained experience with our first successful EV car, we are excited to show off our second iteration with the FAUmax Pi. At the beginning of this season, we decided to focus on the following fields: maximize our testing time by keeping stuck to the schedule, a lightweight design, reliability, aerodynamic performance, and testing time. We are thrilled to present and power up our car in this year's events.

240 kg | **140** kW | **7.7** kWh | **2022** first event | **1** participations in class

Esslingen

University of Applied Sciences Esslingen

Car 94 | Pit 22-C | WRL 199 | Germany

Rennstall Esslingen

After 15 successful years competing in the combustion class of Formula Student, we have embarked on a new journey as a dedicated electric team. However, our story doesn't begin from scratch. Thanks to the years of experience in the electric vehicle (EV) class of our sister team, E.Stall, we have had the incredible opportunity to merge the manpower and knowledge of both teams and create a collaborative project, resulting in a remarkable electric vehicle ready to hit the track!

283 kg | **144** kW | **7** kWh | **2012** first event | **3** participations in class

Freiberg

TU Bergakademie Freiberg

Car 76 | Pit 16-B | WRL 58 | Germany

Racetech Racing Team e.V.

Racetech Racing Team was founded in 2005. After a small hiatus, we will compete with our 14th car this year. After an era of rear-wheel drive cars, the RT14's key design changes are the switch to all-wheel drive and an increased focus on aerodynamics. This resulted in big changes throughout the car's layout and components, which we are proud to show off at this year's events. The RT14 will take on the competition in the Netherlands and Germany. We are looking forward to meeting you in the pits!

275 kg | **148** kW | **6.9** kWh | **2012** first event | **8** participations in class

Glasgow

University of Strathclyde

Car 115 | Pit 41-B | WRL 79 | United Kingdom

University of Strathclyde Motorsport

As Scotland's first Formula Student team, USM has been designing, building, and racing single-seat race cars for 22 years. Driven to be part of something fast, the student-led team has grown to over 50 members, who pride themselves on a mission of delivering sustainable performance after recently making the switch from IC-engine cars. USM is returning to Formula Student Germany for the first time since 2018 - and for the first time in the electric category - with our latest challenger, USM23.

293 kg | **64** kW | **7.3** kWh | **2022** first event

Göteborg

Chalmers University of Technology

Car 95 | Pit 12-C | WRL 73 | Sweden

Chalmers Formula Student

Chalmers Formula Student is the official racing team of Chalmers University of Technology started in 2001. This year, the team of Chalmers Formula Student is excited to present the designed and manufactured both driverless and driver-suited Formula Student racecar called Margareta. It is equipped with four self-made electrical hub motors, forming excellent traction and preparing the car for the sharp corners of Hockenheimring. The team of CFS is thrilled to be participating in FSG again.

293 kg | **128** kW | **6.7** kWh | **2015** first event | **3** participations in class

Göttingen

Hochschule für angewandte Wissenschaft und Kunst Hildesheim/ Holzminden/Göttingen

Car 161 | Pit 20-C | WRL 77 | Germany

Blue Flash Mobility Concepts

We are Blue Flash Mobility Concepts from Göttingen. Comprising of 30 students, we are highly motivated to go beyond our academic studies and acquire experiences that only the Formula Student can provide. This year, we are proudly participating with our seventh racecar, the E_HAWK23. Equipped with our first full Aerodynamics package and a new 10" Wheel & Suspension assembly, we are ready to compete. This not your average student project - we turn Students into Engineers!

266 kg | **80** kW | **7.7** kWh | **2016** first event | **6** participations in class

Hamburg

Technische Universität Hamburg

Car 78 | Pit 44-A | WRL 31 | Germany

e-gnition Hamburg

e-gnition Hamburg was founded in 2011 and participates in the EV since 2012 and DV class since 2017. After introducing a new aerodynamics package and wheel assembly in the last season, the egn23 design concentrates on improving the powertrain reliability. For this, not only the accumulator is redesigned but also a motor test bench is constructed to validate the inverter settings. This makes the egn23 stronger and faster than ever!

278 kg | **140** kW | **6.2** kWh | **2012** first event | **9** participations in class

Hamburg

University of Applied Sciences Hamburg

Car 196 | Pit 14-C | WRL 106 | Germany

HAWKS Racing e.V.

Last year we proved that electric cars don't have to be quiet. With our second electric vehicle "Nayra" we'll try to take it up a step and bring some more noise to the track. The eighteenth car built by HAWKS Racing inherits all of the history of the Team in true 69 spirit (even if the car number says something different). With a revised drive train concept and newly developed embedded systems we want to attack once again, even without a driver.

293 kg | **109** kW | **7** kWh | **2022** first event | **1** participations in class

Hannover

Leibniz Universität Hannover

Car 23 | Pit 34-A | WRL 125 | Germany

HorsePower Hannover

HorsePower Hannover was founded in 2007 and first competed as a combustion team in 2009. The first electric car was build in 2011, the electricHorse11. This season, we build our 12th electric vehicle, the eH23, with an AWD concept with four individual wheel hub drives, CFRP aluminium sandwich monocoque, full aerodynamic package and an HV accumulator stored in the rear.

307 kg | **144** kW | **6** kWh | **2011** first event | **7** participations in class

Helsinki

Helsinki Metropolia University of Applied Sciences

Car 98 | Pit 04-B | WRL 97 | Finland

Metropolia Motorsport

Metropolia Motorsport is one of the most northern Formula Student team in the world, and only Finnish team competing in electric series. For this season we decided to take a bigger development leap by designing and manufacturing our first monocoque made out of carbon fiber. Alongside with the new chassis we implemented new accumulator, decoupled suspension with heave and roll elements, redesigned aero package and second version of 4WD powertrain to our newest vehicle HPF023.

272 kg | **140** kW | **7** kWh | **2013** first event | **3** participations in class

Hsinchu

National Tsing Hua University

Car 68 | Pit 10-A | WRL 21 | Taiwan

NTHU Racing

We are NTHU Racing, a young Taiwanese team established in 2015, having designed and built an impressive fleet of six cars, consisting of three combustion and three electric vehicles. After our successful debut in FSG last year, we are thrilled to return with our first-ever driverless car - TH07. We have achieved significant advancements by new aluminum monocoque and enhancing the battery cooling system, resulting in improved endurance performance.

311 kg | **141** kW | **8** kWh | **2018** first event | **1** participations in class

Ilmenau

Ilmenau University of Technology

Car 171 | Pit 32-B | WRL 177 | Germany

Team Starcraft e.V.

Team Starcraft is the Formula Student Team of the TU Ilmenau and combines a wide variety of courses. In racing, progress and efficiency play a major role. Therefore, we have been building purely electric race cars since 2011. The main design goal for this year's car was to highly improve the performance of our self-developed inverters. Therefore we reworked both hardware as well as software. We put a lot of emphasis on lightweight and better reliability of our monocoque and mechanical parts.

243 kg | **120** kW | **8.3** kWh | **2012** first event | **5** participations in class

Ingolstadt

Technische Hochschule Ingolstadt

Car 34 | Pit 40-B | WRL 47 | Germany

Schanzer Racing Electric e.V.

Schanzer Racing Electric was founded in 2010 and competed in Formula Student Electric for the first time in 2012. As a team of the university of applied sciences Ingolstadt, we are located in the south of Bavaria, north of Munich. Our new car, the SRe23, is the 10th overall vehicle which was developed and manufactured in Ingolstadt. The goal for this season was to maximize our testing time to guarantee as much reliability as possible, more on track development and driver training.

283 kg | **140** kW | **7.8** kWh | **2012** first event | **9** participations in class

Innsbruck

University of Innsbruck

Car 107 | Pit 14-B | WRL 144 | Austria

Campus Tirol Motorsport

Welcome to Campus Tirol Motorsport (CTM), located in Innsbruck, in the heart of the Alps! We are a group of students from four universities in Tyrol. Presenting our 5th-gen electric racecar, featuring a steel space frame and rear-wheel drive. With a new accumulator concept and improved electronics and software, we want to make our mark in the Formula Student world, connecting with other teams, visitors and companies. Let's embrace innovation and push the boundaries of engineering!

260 kg | **72** kW | **6.3** kWh | **2021** first event

Kaiserslautern

RPTU Kaiserslautern-Landau

Car 164 | Pit 12-A | WRL 105 | Germany

Kaiserslautern Racing Team

The Kaiserslautern Racing Team is a collaboration of students from both the RPTU and UAS Kaiserslautern, located in south-western Germany. The Electronyte e23 marks the 11th electric racecar designed by the team. It features all-wheel drive with wheel hub motors and ring gear driven rims, aswell as a roll-heave-suspension. To achieve maximum performance, the design is focused on a compact packaging using a carbon fibre monocoque while still allowing reasonable maintainability of the car.

278 kg | **142** kW | **7** kWh | **2012** first event | **7** participations in class

Karlsruhe

Karlsruhe Institute of Technology

Car 120 | Pit 09-B | WRL 15 | Germany

KA-RaceIng Electric

After one year of autonomous vacation, KA-RaceIng e.V. is now back with their first EV-DV car. Building up on the newly developed platform of the KIT21e as a more aero focused platform, we did incremental changes, saved further weight and integrated the successful Autonomous System of the KIT21/22d to form the KIT23.

261 kg | **101** kW | **7.3** kWh | **2010** first event | **11** participations in class

Kassel

University of Kassel

Car 28 | Pit 29-B | WRL 216 | Germany

Herkules Racing Team Kassel

Rebuild, reuse and reimagine are the keywords for 2023. A solid and reliable racing car is the goal of our season. Due to many problems with the switch from combustion to electric power, we decided to recycle some parts from the last year's car and focus on the parts that cause problems. In addition to our wooden wings, we use 100% biodegradable 3D printed parts for the aerodynamic package. Thanks to all our sponsors who supported us.

200 kg | **140** kW | **6.7** kWh | **2018** first event | **2** participations in class

Konstanz

University of Applied Sciences Konstanz

Car 43 | Pit 38-A | WRL 103 | Germany

Bodensee Racing Team

With its third electric race car, the Bodensee Racing Team is once again aiming to set new technical standards for the Iltis series of race cars this season. It will be the first time a race car from the HTWG Konstanz with 4WD and wheel hub motors is taking part in the FSG. Furthermore, featuring a new evolution of our accumulator and a new 10" suspension with additive manufactured uprights. We are looking forward to racing at the Hochenheimring for the 12th consecutive season. See you on track!

274 kg | **144** kW | **6.8** kWh | **2021** first event | **2** participations in class

Lausanne

École Polytechnique Fédérale de Lausanne

Car 127 | Pit 28-B | WRL 89 | Switzerland

EPFL Racing Team

We present Ariane, EPFL Racing Team's fourth ever vehicle! After a successful 2022 season, we have decided to introduce a number of technological improvements such as a move from a 2-wheel drive system to a 4-wheel drive in-wheel propulsion with traction control and torque vectoring, increasing battery voltage from 430 to 600V, going from a semi- to a full carbon monocoque, a new heave-roll suspension architecture, improved aerodynamics and the introduction of our first driverless systems.

308 kg | **141** kW | **9.3** kWh | **2019** first event | **3** participations in class

Lemgo

Technische Hochschule Ostwestfalen-Lippe

Car 53 | Pit 31-A | WRL 213 | Germany

OWL Racing-Team

Celebrating 15 years since its foundation in 2008, the OWL Racing-Team is presenting its newest addition to the electric race car lineup: the OWL2.3. For our fourth electric vehicle since the switch from combustion engines, we aimed to build an even more reliable car that's able to compete with the best teams. Improving the best features of our previous cars with today's knowledge and experience, we're excited to demonstrate what a team of people with diverse fields of study can achieve.

303 kg | **124** kW | **6.4** kWh | **2019** first event | **1** participations in class

Lisboa

Universidade de Lisboa - Instituto Superior Técnico

Car 50 | Pit 43-C | WRL 61 | Portugal

FST Lisboa

FST Lisboa was established in 2001 as the Formula Student team from University of Lisbon, and currently consists of 55 members. This year, the team presents its 12th prototype, the FST12, specifically designed to include autonomous capabilities while maintaining high electric performance. This year's focus was to facilitate the coexistence of both driving modes and increase the testing time of our new controllers. Aerodynamic and cooling performance were also priorities in the FST12's design.

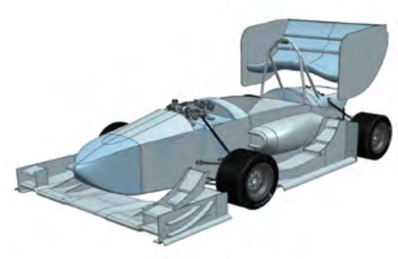
295 kg | **140** kW | **7.7** kWh | **2011** first event | **6** participations in class

Ljubljana

University of Ljubljana

Car 169 | Pit 44-B | WRL 157 | Slovenia

Superior Engineering FS Ljubljana



Superior engineering is a Formula Student team from University of Ljubljana. The team was established in 2015. This year, we are competing with our fifth electric car. The two electric motors power the rear axles and draw current from the battery mounted underneath the car. This year's design is a bit of a revolution as we apply some new design concepts to our racecar, such as chassis and battery design. After last year's car problems, we are coming back stronger and faster!

206 kg | **108** kW | **8.2** kWh | **2018** first event | **1** participations in class

Magdeburg

Otto von Guericke University of Magdeburg

Car 20 | Pit 28-A | WRL 168 | Germany

UMD Racing e.V.

After years as a combustion team, UMD Racing built their first electric car in 2022 and are now building our second: "Edelbert". We're really looking forward to competing at Formula Student UK and Formula Student Germany this summer and representing not only the Otto-von-Guericke University Magdeburg, but also, as the only team in Saxony-Anhalt, our entire state. The team is highly motivated to pass all technical scrutineering this year and to finish the Endurance with a respectable time.

303 kg | **109** kW | **7.8** kWh | **2022** first event

Mannheim

Duale Hochschule Baden-Württemberg - Mannheim

Car 101 | Pit 19-B | WRL 75 | Germany

CURE

In the 2023 season, we are competing for the second time in EV and DC at Formula Student Germany. The collaboration between engineering and business students from DHBW within the CURE Mannheim team brings a diverse range of skills and expertise to the table. Together, we are forming a team of over 30 active members. Our main goals for this season are the implementation of complex vehicle dynamic control systems and going through all autonomous disciplines successfully.

308 kg | **180** kW | **7.1** kWh | **2018** first event | **2** participations in class

Milano

Polytechnic University of Milan

Car 90 | Pit 32-A | WRL 49 | Italy

Dynamis PRC

Dynamis PRC, after 15 years of combustion prototypes, switched to the EV category in 2021. The team is now at his 3rd year in the electric category and in its second in the driverless one. This year car, the DP14, is an evolution of the 2022 prototype that aims at resolving the weaknesses of its predecessor. A lot of effort has been put on the low voltage system, on the control system, on the handling and upgrades have been done to improve the reliability of the car.

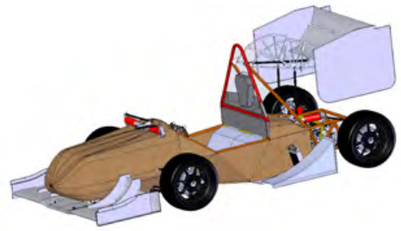
267 kg | **140** kW | **8.1** kWh | **2021** first event | **1** participations in class

Mittweida

University of Applied Sciences Mittweida

Car 170 | Pit 35-B | WRL 185 | Germany

Technikum Mittweida Motorsport



In memory of the well-known automotive pioneer August Horch, who himself studied at the University of Applied Sciences Mittweida from 1888-1891, students of mechanical engineering came together in 2006. As "Technikum Mittweida Motorsport" they began to develop their first racing car for Formula Student. Since 2018 the team has been developing electric vehicles and will compete this season with their Black Mamba.

319 kg | **68** kW | **8.2** kWh | **2019** first event | participations in class

Montréal

University of Québec - ETS

Car 88 | Pit 31-B | WRL 44 | Canada

Formule ETS

Formule ETS is composed of 25 dedicated engineering students who thrive for success. MANIC-23 is our third electric car and our first with driverless capacity. It integrates a highly compact 600V accumulator, 3D-printed aluminum uprights machined in-house, lightweight heave and roll decoupled suspension system, a full CFRP-monocoque optimized for high stiffness combined with a high downforce aerodynamic package. Our concept is validated with the help of extensive data acquisition and testing.

248 kg | **140** kW | **7.4** kWh | **2022** first event

Moscow

Bauman Moscow State Technical University

Car 21 | Pit 44-C | Russia

Bauman Racing Team

Bauman Racing Team was founded in 2012 and on our 10-year anniversary, we are entering a new era for our team by presenting to you our first electric and driverless racing car - BRT8D. By taking such responsibility, we have faced a number of challenges in using most of the cutting-edge technologies. But because of that, BRT8D came out to be able to succeed in any task that racing track and competition have to offer!

367 kg | **100** kW | **9.6** kWh

München
Technical University of Munich

Car 31 | Pit 04-A | WRL 40 | Germany

TUfast Racing Team e-Technology

The TUfast Racing Team from the TU Munich (TUM) is a Formula Student team with a remarkable 21-year legacy. Our xb023 represents our third vehicle incorporating both manual and fully autonomous driving. With a dedicated team of 80 members, we focused on two key objectives: ensuring reliability in our electrical system, and enhancing performance with cutting-edge active aerodynamics, self designed roll dampers and much more. If we caught your attention, visit us in our pit for more details.

234 kg | **140** kW | **6.20** kWh | **2011** first event | **10** participations in class

München
University of Applied Sciences München

Car 113 | Pit 04-C | WRL 71 | Germany

municHMotorsport

Passionworks – not only the name of our cars but also the guiding principle of our team. The team of the UAS Munich was founded in 2005 and participates at the FS events since 2006. Actually the team consists of 50 members of many different faculties whose aim is to create a car which represents our team, the university and our sponsors. This year, we're happy to announce that we designed a car that signifies a revolutionary step.

264 kg | **140** kW | **7.3** kWh | **2010** first event | **11** participations in class

New Delhi
Indian Institute of Technology Delhi

Car 117 | Pit 25-A | WRL 107 | India

Axlr8r Formula Racing

Axlr8r Formula Racing is a team of 35 enthusiastic undergraduates from the Indian Institute of Technology Delhi, India, working towards setting up a milestone in Formula Student competitions. Founded in 2006, the team has successfully built 5 combustion and 4 electric vehicles. With an improved analytical understanding of each subsystem, the team is ready to take a leap with XLR-23 as a faster, more reliable and safer car than all of its predecessors.

300 kg | **104** kW | **8.7** kWh | **2016** first event | **3** participations in class

Osnabrück
University of Applied Sciences Osnabrück

Car 167 | Pit 09-C | WRL 251 | Germany

IRT electric

The Ignition Racing Team electric is a student association founded in 2006. Since 2011 we have been building cars with an electric drivetrain. After some hard years with the Corona pandemic and no running cars, we now have a young and motivated team. This year we will participate in two competitions in Europe. With our new AMS based on a new microchip, we are confident to have a reliable car. Now we are very excited to meet you all in Hockenheim and compete against each other.

248 kg | **72** kW | **7.6** kWh | **2011** first event | **8** participations in class

Pisa
University of Pisa

Car 65 | Pit 22-B | Italy

E-Team Squadra Corse

The E-Team Squadra Corse was born in 2007 out of the University of Pisa's desire to combine passion for such a forward-looking field and students' know-how. More than 100 students are put to the test in management and design. The Combustion and Driverless prototypes of the 2022 season excelled in Business Plan, Cost Report, best design and the Erre Prize "Know how agility and problem solving." 2023 is the electric season: two rear motors with hybrid chassis, metal trellis and carbon monocoque

342 kg | **120** kW | **7** kWh

Porto
University of Porto

Car 32 | Pit 07-B | Portugal

Formula Student FEUP

FS FEUP was created in July 2021 with the clear objective of a 2-year beginning project. In the first year, the Team aimed to compete in Concept Class to gain FS knowledge and to validate the prototype design, and in the second year, compete with a working prototype in Class 1. Last year the Team competed in FS UK and FSAE Italy in Concept Class which enabled a strong preparation for the manufacturing process. This year the team will compete in FS UK, FS PT and FSG with our first ever EV.

358 kg | **109** kW | **7** kWh

Pune

Pimpri Chinchwad College Of Engineering

Car 17 | Pit 06-C | WRL 7 | India

Team Kratos Racing Electric

Established in 2015, Team Kratos Racing Electric consists of 40+ dedicated engineers. Our exceptional performance in the Combustion category led to three National Championships. In 2018, we embraced a new challenge by transitioning to the Electric category, where we bagged the National Champions for an additional three times. Fueled by our success on the domestic front, we set our sights on international competitions with our innovative self-designed BMS, LSD, and India's 1st Prepreg Monocoque.

263 kg | **68** kW | **7.9** kWh | **2022** first event

Regensburg

Ostbayerische Technische Hochschule Regensburg

Car 62 | Pit 34-B | WRL 122 | Germany

Dynamics e.V.

Dynamics e.V. was founded in 2007 to build combustion race cars until 2019. As the fourth electric race car and further development of the overall concept developed in the pre-season, the RP23e is our best and most sophisticated car to date. We compete the season with a focus on the reliability of the concepts, good manufacturing quality, but also the improvement of all systems.

259 kg | **140** kW | **7.1** kWh | **2011** first event | **4** participations in class

Schweinfurt

University of Applied Sciences Würzburg-Schweinfurt

Car 97 | Pit 20-A | WRL 60 | Germany

Mainfranken Racing

Mainfranken Racing e.V. was founded in 2006 out of the idea of some motorsport enthusiastic students from the University of Applied Sciences Schweinfurt. The MF15 is the team's 4th electrical car the team is building. This year's goal is to integrate autonomous driving into our vehicle for the first time. In addition, the focus is on the production of a new lithium-ion accumulator with a self-developed aramid accumulator container.

274 kg | **107** kW | **7.5** kWh | **2019** first event | **3** participations in class

Sevilla

University of Seville

Car 51 | Pit 46-B | WRL 72 | Spain

ARUS

ARUS, the first Formula Student team from Andalucía, southern Spain, was founded in 2012. Since then, they have designed and manufactured 8 combustion and 5 electric cars. In 2021, their electric car successfully passed scrutineering and completed the endurance race for the first time. And last year, they got their first overall podium in FS ATA. This year, the team has focused on optimizing performance, incorporating a new HV battery, while maintaining reliability through testing.

300 kg | **109** kW | **7.4** kWh | **2018** first event | **3** participations in class

Stockholm

KTH Royal Institute of Technology

Car 71 | Pit 16-A | WRL 174 | Sweden

KTH Formula Student

Driven by our core values: innovation, challenge, and teamwork, KTH Formula Student has developed a unique racecar, which is a complete redesign from the previous generations of cars. Not only the looks but also the innovation implemented in the DEv17 means that we are proud to present our first 4wd car with our first carbon fiber monocoque in over a decade! On completing the first generation of this car, the team will focus on improving this concept in the future, as still a lot can be learned!

271 kg | **56** kW | **6.2** kWh | **2011** first event | **2** participations in class

Stralsund

University of Applied Sciences Stralsund

Car 22 | Pit 43-A | Germany

Baltic Racing

In its 24th season, Baltic Racing is heading into the future, changing two mayor concepts of its car.Representing the team´s first EV, TY22evo marks the beginning of a new era for the team. Its platform is given by a newly developed monocoque made from aluminum sandwich. For maximum performance the Aerodynamics produce double the amount of downforce the team's previous car did.With this development, the team is building a platform for future progress and prepares to attend its 15th FSG Event.

305 kg | **136** kW | **7.4** kWh

Stuttgart
University of Stuttgart

Car 26 | Pit 23-A | WRL 1 | Germany

GreenTeam Uni Stuttgart

The GreenTeam Uni Stuttgart e.V. was founded in 2009 by alumni of the Rennteam. Currently it consists of 48 members. Since its founding, the GreenTeam has established itself as one of the top teams in Formula Student competition, achieving numerous successes. With its recent success, a new world record was set for acceleration from 0 to 100 km/h in 1.461 s. This year, in addition to optimizing individual components, the team has focused on the driverless system in the E0711-13.

248 kg | **172** kW | **7.7** kWh | **2010** first event | **12** participations in class

Stuttgart
Baden-Württemberg Cooperative State University Stuttgart

Car 77 | Pit 35-A | WRL 10 | Germany

DHBW Engineering Stuttgart e.V.

Our team, the DHBW Engineering Stuttgart e.V., consists of 110 motorsport enthusiast students from the DHBW Stuttgart. Founded in 2008, we are ready to compete in our 14th season. Each season we try to build on our previous successes, improve our performance and strive to improve our lap times. Due to our unique way of studying and working, we rely heavily on a great team spirit, which leads us to our motto: It takes an A-Team to build an e-car.

252 kg | **144** kW | **6.8** kWh | **2012** first event | **9** participations in class

Tallinn
Tallinn TU - University of Applied Sciences

Car 124 | Pit 19-C | WRL 12 | Estonia

FS Team Tallinn Electric

FS Team Tallinn has built competitive formula cars in Estonia since 2006. Although far away from the automotive industry Team Tallinn guys have proved time and time again their work ethic and stubbornness to achieve set goals. This year is one of our most ambitions season yet with the integration of the driverless system and a new concept optimized for aerodynamics and maximum tire potential usage. We strive to redeem our promising results at FSG last year.

246 kg | **140** kW | **8.2** kWh | **2013** first event | **2** participations in class

Trento
Università degli Studi di Trento

Car 111 | Pit 25-C | WRL 127 | Italy

E-Agle Trento Racing Team

We are E-Agle Trento Racing Team from the University of Trento, Italy. We were born in 2016 as an electric team and today, we are a group of 80 students with a focus on 3d printing technology, advanced software solutions and in-house design and manufacturing. Fenice EVO marks a radical improvement over our previous car: all new LV and HV electronics, both on software and hardware, a new active Anti-Roll bar and a full aerodynamic package. We are thrilled to be back at the Hochenheimring!

336 kg | **120** kW | **6.2** kWh | **2017** first event | **1** participations in class

Trondheim
Norwegian University of Science and Technology

Car 63 | Pit 29-A | WRL 51 | Norway

Revolve NTNU

Revolve NTNU was founded in 2010. We developed two combustion cars, before switching to electric in 2014, and we had our first 4WD electric car in 2016. Since 2017 we have been developing both an autonomously and a manually driven race car each year. Last year the first combi-car with both manual and autonomous driving capabilities was made. This year, we are presenting our 11th car, with improved autonomous capabilities, new in-house developed systems and a focus on data and data-driven design.

227 kg | **141** kW | **7** kWh | **2014** first event | **7** participations in class

Ulm
Technische Hochschule Ulm

Car 42 | Pit 20-B | WRL 62 | Germany

Einstein Motorsport

Einstein Motorsport is the Formula Student team from Ulm, Germany, founded in 2006. The series of combustion race cars concluded in 2019 with the AL19 and 22nd place in the world rankings. Since then, the team has been working on its electric-autonomous race car. Last season, the vehicle raced on formula student events for the first time. Now that the first working base exists, the primary focus is on further performance development and issues such as reliability and maintenance.

267 kg | **70** kW | **7.4** kWh | **2022** first event | **1** participations in class

Weihai

Harbin Institute of Technology at Weihai

Car 66 | Pit 37-B | WRL 238 | China

HIT Racing Team

We are HIT Racing Team (a.k.a HRT) from China, which was founded in 2009. Our EV team was founded in 2012 and the DV team was founded in 2017. Two teams have merged into one in 2019 while we have been participating in many competitions and have gained over 100 awards. This year, we brought a brand new car, HRT-23DE, to race outside of China for the first time since the pandemic. We are very much looking forward to learning and communicating with a series of international teams.

288 kg | **128** kW | **7.5** kWh | **2014** first event

Weingarten

University of Applied Sciences Ravensburg-Weingarten

Car 60 | Pit 17-C | WRL 120 | Germany

Formula Student Team Weingarten

We are the Formula Student Team Weingarten and celebrate our 15th anniversary this season with our Stinger 23E. From our experience we want to improve reliability and process quality more and more. Of course, the lightweight philosophy of Weingarten is not forgotten. In building our second electric race car, it is important for us to create a sustainable team culture, to get the best out of the Team and of the car.

248 kg | **140** kW | **8.2** kWh | **2022** first event | **1** participations in class

Wien

Vienna University of Technology

Car 41 | Pit 17-B | WRL 22 | Austria

TU Wien Racing

Another season and we are coming in strong with a new car, the EDGE14, and a team full of talented, passionate members. With the experience gained over the past years, we set out to build our most successful car yet. Prepare to be amazed as we've pushed boundaries, optimizing aerodynamics and shedding weight from the monocoque. Once again, our team is ready, excited and prepared to hit the track here in Hockenheim and to show what we have been working on. We are one - 41!

248 kg | **172** kW | **6.6** kWh | **2014** first event | **6** participations in class

Wolfenbüttel

University of Applied Sciences Ostfalia

Car 35 | Pit 06-A | WRL 28 | Germany

Team wob-racing.

Team wob-racing's making history in 2023, that's for sure. Founded in 2003 by Automotive Engineering students, we're celebrating our 20th anniversary. Now we're proudly bringing our WR17 on track. More than 45 % increase of downforce @60 kph, in-house developed inverters and a slimmer monocoque are just few examples of our result of hard work. After a year without events, we want to make a good start and reward all the many students who've given a lot in 20 years of Team wob-racing.

259 kg | **136** kW | **7.1** kWh | **2012** first event | **6** participations in class

Zürich

Swiss Federal Institute of Technology Zurich

Car 33 | Pit 12-B | WRL 35 | Switzerland

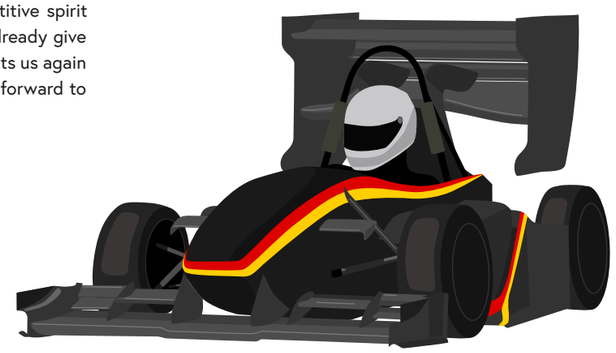
AMZ Racing Team

The AMZ Racing team was founded in 2006 by students of ETH Zurich. Since 2010 AMZ Racing has been developing electric race cars. For this season the AMZ Racing Team built their 16th car, castor. It is powered by self-developed power electronics and motors. A hydraulic roll and warp-decoupled suspension is also implemented on the car. The aerodynamic kit increases grip with the help of a 3D front wing main element and tire wake control features. The car features a fully integrated driverless kit.

244 kg | **174** kW | **6.4** kWh | **2010** first event | **12** participations in class

Thanks to all participants

Dear teams, we wish you abundant success and competitive spirit for this year's Formula Student Germany. Your designs already give an idea of the colourful and diverse atmosphere that awaits us again on the race track. We are genuinely excited and looking forward to enjoying again your passion for motorsport.



Memes*
– FSG Officials Edition

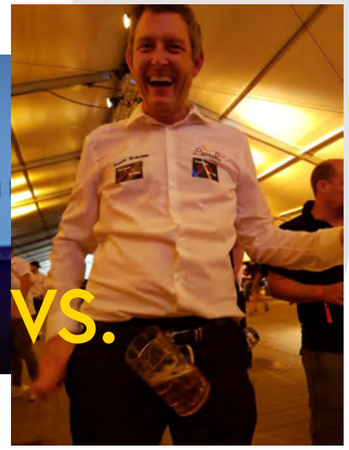
Written by Theresa Stach

These pages are dedicated to our many volunteers. Some insider information may be necessary for understanding. Do not be afraid to approach us.

Diese Seiten sind unseren zahlreichen Freiwilligen gewidmet. Möglicherweise sind zum Teil für das Verständnis Insiderinformationen notwendig. Scheuen Sie sich nicht auf uns zuzugehen.

How I look during the show

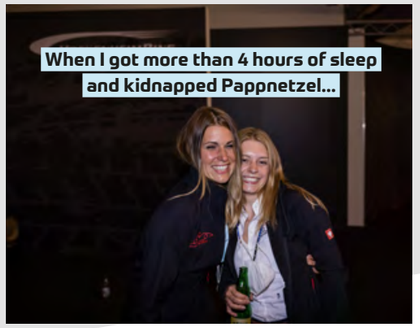
After the show



VS.

Of course, the scenes with beer in hand were shot in the after-work hours. / Natürlich sind die entstanden Szenen mit Bier in der Hand im "Feierabend" entstanden.

When they tell us MAHLE party is over...



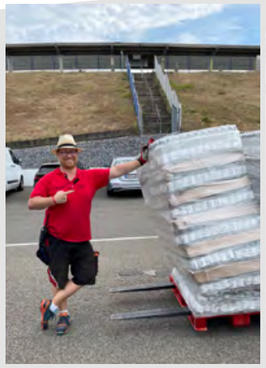
For more infos watch the whole kidnapping-story:

How I thought I would pack for Technical Inspection

How I actually pack

VS.

How I try to hold my life together



How my friends try to help me...

* A meme is creative content that spreads primarily on the Internet. This is usually humorous and exhilarating, sometimes satirical and correspondingly critical of society. Memes can be self-created works, but also montaged photographs, drawings, animations, or films by others or taken out of their original context.

* Ein Meme ist ein kreativer Inhalt, der sich vorwiegend im Internet verbreitet. Dieser ist in der Regel humoristisch und aufheiternd, manchmal auch satirisch und entsprechend gesellschaftskritisch. Bei Memes kann es sich um selbsterstellte Werke handeln, aber auch um montierte oder aus dem ursprünglichen Kontext gerissene Fotografien, Zeichnungen, Animationen oder Filme von anderen.

Formula Student Worldwide

1001 teams – 56 nations – 5 continents – one passion

Every year students from various disciplines share their enthusiasm for the competition. The various venues are visited annually by hundreds of student teams. The Formula Student community is growing steadily and other countries are joining in with their own competition. After a break of four years we are more than happy to welcome our colleagues and friends from all over the world at this years World Council Meeting in Hockenheim.

1001 Teams – 56 Länder – 5 Kontinente – eine Leidenschaft

Jedes Jahr teilen weltweit Studierenden unterschiedlicher Fachrichtungen ihre Begeisterung für den Wettbewerb. Die verschiedenen Austragungsorte werden jährlich von hunderten studentischen Teams besucht. Die Formula Student-Gemeinschaft wächst stetig und weitere Länder schließen sich mit einem eigenen Wettbewerb an. Nach vier Jahren Pause freuen wir uns umso mehr, unsere Kolleginnen und Kollegen aus der ganzen Welt für das diesjährige World Council Meeting in Hockenheim begrüßen zu dürfen.

FS
Germany
14.08.2023 – 20.08.2023
Hockenheimring
Competitions: C E D

FS
Netherlands
08.07.2023 – 13.07.2023
TT Circuit Assen
Competitions: C E H

Formula FSAE
Brasil
08.02.2023 – 06.08.2023
ECPA – Esporte Clube Piracicabano de Automobilismo
Competitions: C E

Formula FSAE
Michigan
17.05.2023 – 20.05.2023
Michigan International Speedway, MI
Competitions: C

FS
Portugal
31.07.2023 – 06.08.2023
Castelo Branco Motorsport Park
Competitions: C E D

Formula FSAE
Michigan
14.06.2023 – 17.06.2023
Michigan International Speedway, MI
Competitions: E

FS
UK
19.07.2023 – 23.07.2023
Silverstone
Competitions: C E D H

FS
Switzerland
01.07.2023 – 05.07.2023
Switzerland Innovation Park Zürich
Competitions: E

Formula FSAE
Italy
12.07.2023 – 16.07.2023
Riccardo Paletti Circuit, Varano 'de Melegari, Parma
Competitions: C E D

FS
Spain
06.08.2023 – 12.08.2023
Circuit de Catalunya
Competitions: C E D

FS
Poland
27.08.2023 – 30.08.202
Autodrom Słomczyn
Competitions: C E D H

FS
EAST
01.08.2023 – 06.08.2023
Hungaroring
Competitions: C E D H

FS
Czech
07.08.2023 – 12.08.2023
Autodrom Most test track
Competitions: C E D H

FS
Austria
22.07.2023 – 27.07.2023
Red Bull Ring
Competitions: C E H

FS
Alpe Adria
21.08.2023 – 26.08.2023
St Rauš, Novi Marof
Competitions: C E D H

FS
Romania
31.07.2023 – 05.08.2023
Autodrom Most test track
Competitions: C E D H

Formula
Bharat
19.01.2024 – 24.01.2024
Kari Motor Speedway in Coimbatore
Competitions: C E

Formula FSAE
Thailand
21.11.2023 – 21.11.2023
Pathumthani Circuit
Competitions: C E

Formula FSAE
Australasia
07.12.2023 – 10.12.2023
Winton Motor Raceway, Rural City of Benalla, Victoria
Competitions: C E D

Formula FSAE
Japan
28.08.2023 – 02.09.2023
Ogasayama Sports Park ECOPA
Competitions mixed: C E

Formula FSAE
Korea
25.08.2023 – 27.08.2023
Samangeum Gunsan Automobilrennbahn
Competitions: C E

FS
China & FSEC
Autumn / Winter 2023
Competitions: C E D

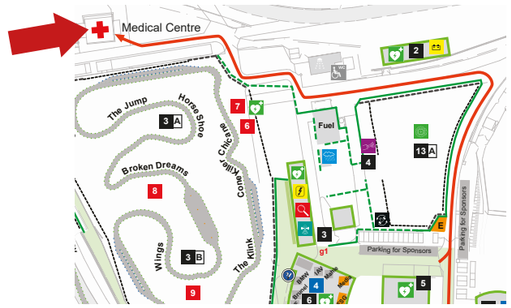
World Ranking Lists

C https://fs-world.org/C/

E https://fs-world.org/E/

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

https://fsg.one/hospital

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 - Pascal Heuter	+49 (151) 560 747 00
Event Support - Matthias Brutschin	+49 (151) 560 747 02

(In case of an emergency please call 112 and afterwards Pascal or Matthias.)

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 an 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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FORMULA STUDENT GERMANY 2023

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