

Photo Courtesy: Emrax

# TEAM DEFIANZ RACING

## NEWSLETTER MAY 2020



# MEMORIA

THE BEST OF OUR MEMORIES TOGETHER



## ***Family time!***

This photo was shot right after a monday meeting last summer, planned after which was a team feast at vaishno dhaba!

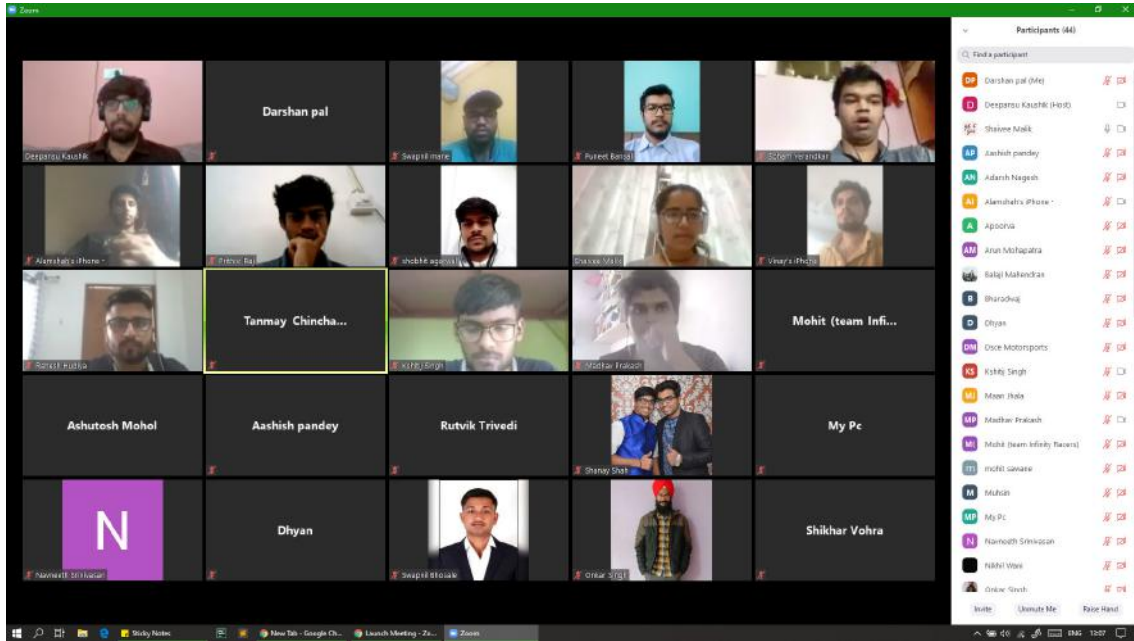
For those who don't know/remember, vaishno is our staple go-to restaurant and one of the prime hotspots for team bonding after the workshop.

We all know that next morning, lord vaishno might shower his blessings upon us and keep us bed-ridden (more like washroom ridden) but it takes more than that to stop us from visiting the place!

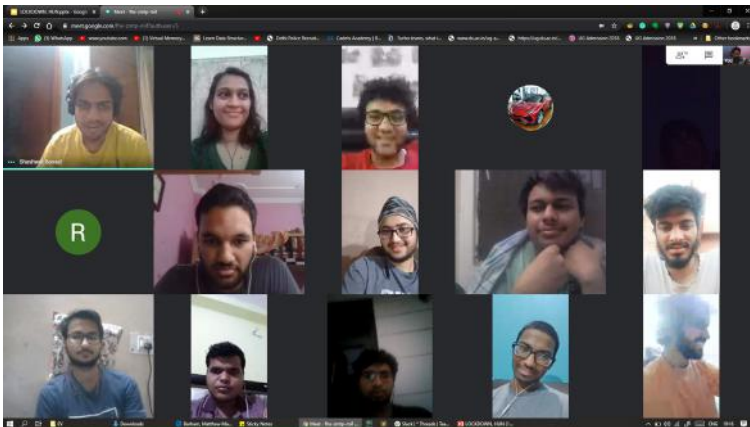
Here's to all the vaishno trips we've had, and the ones to come!

# UNFILTERED

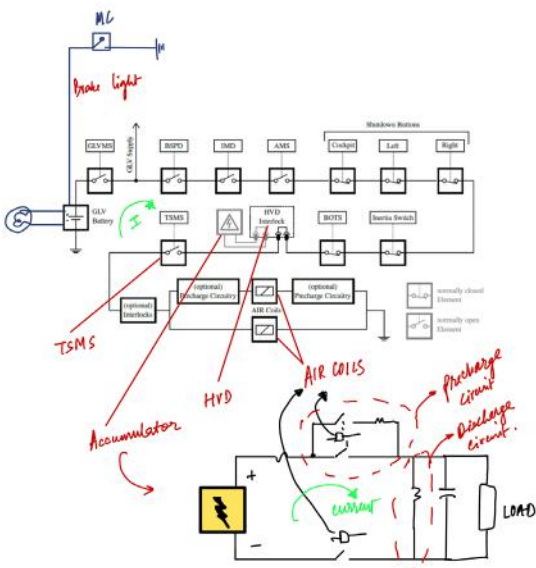
## EVERY PICTURE TELLS A STORY



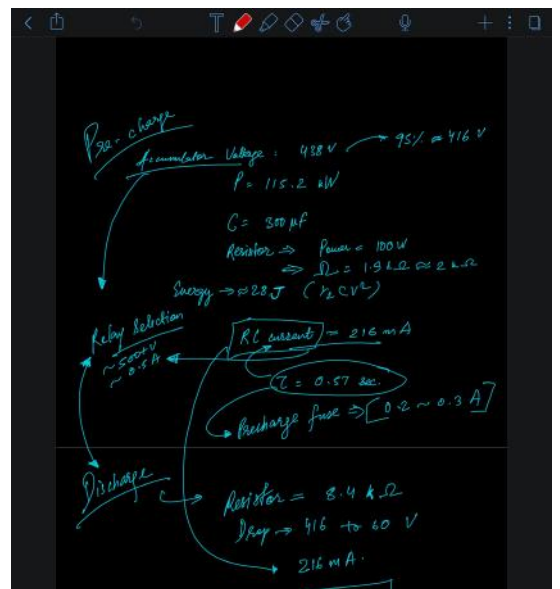
A screenshot from a meeting involving captains from FS teams all over the country for a joint-statement discussion.



*Just another team meeting in action!*



Bits and pieces  
from technical  
discussions



# TEAM UPDATES

## LOCKDOWN EDITION 2.0

### •FSEV

With the ongoing COVID-19 crisis, the team has decided to make well use of the time on its hands and has shifted their attention into learning the functioning of electrical systems and manufacturing of Electric Vehicles.

### •Departments:

Team members have been split into four sub-departments for smooth internal functioning namely:

- 1) High voltage system
- 2) Low voltage system
- 3) Accumulator
- 4) Procurement strategy

### •Overall progress

After a month of thorough study into the fundamentals of Electric Vehicle architecture, **the team has now swiftly moved onto the design of various subsystems** and is looking into the selection, procurement, manufacturing and assembly of various components of the Electric subsystems.

The team also had a meeting with our fellow members of **Hertz Electric and have combined our efforts to work on the FSEV challenge**. We are also looking forward to working with them for Formula Bharat 2021, to develop both a CV and an EV for the competition. The team believes it will be beneficial to both the teams and will help mould our new and upcoming engineers to focus their energy in the right direction, seeing **the decision being made to changes in the industry**.

The team is also making sure that it is fully equipped before attempting the **Formula Bharat 2021 Qualifying quiz** and is undertaking regular rulebook test sessions for the same.

Here, we'd like to give a shoutout to our rising quizmaster, **Rohan Verma!**

Rohan has consistently been on the top of the charts of individual rulebook quizzes held in the past days. Keep it up, boy!

# DEPARTMENTAL UPDATES:

## •High Voltage System

- The department members began by studying relevant rulebook sections and looking into the basics of the tractive system components.

- The department conducted a comparative study for the motors and the controllers. It was decided that EMRAX 228 seems to be the most feasible motor for our purposes due to its outstanding power density.

- Controller selection is in its final stages. The team has been offered a sponsorship discount from DTI for their HV500 controller and is considering to utilise their controller due to its affordability and compatibility with the EMRAX motors.

- A wiring diagram for the high voltage circuit components was made and the department looked at the characteristics of suitable wires, interlocks, harness etc that would serve our purposes.

- The department is also currently involved with designing the pre charge and discharge circuits for the motor controller.

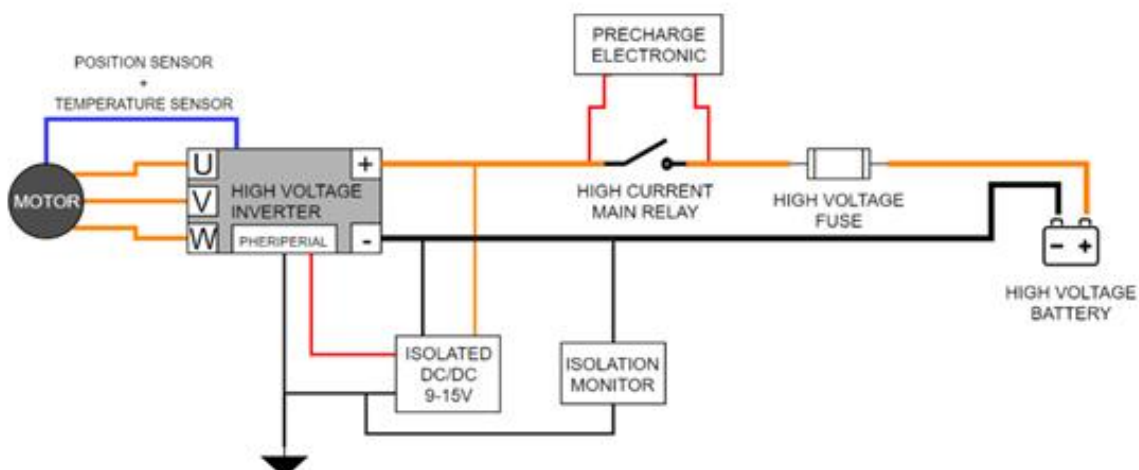
- Moving forward, the department is going to be focusing on the schematic design of other electronics systems, documentation and working on the competition reports.



EMRAX 228



DTI HV500

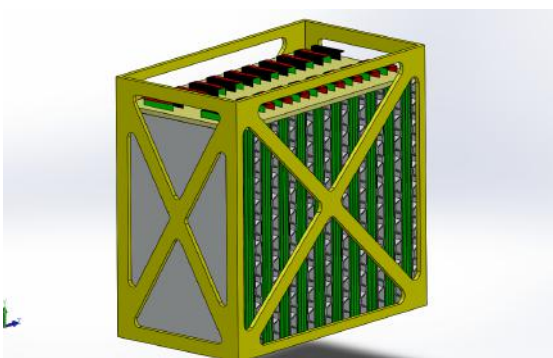


HVS wiring diagram in progress



## •Accumulator

- The department began by studying the basics of an accumulator.
- Inter-departmental divisions were made, with members looking into Electrical design, Mechanical design and the procurement of components for the accumulator.
- Cell selection: Pouch cells with certain main characteristics like capacity and discharge current were shortlisted; the team is in conversation with various companies for the obtaining quotes on the same, including melasta and vertical partners west. Materials for packaging of accumulator are currently under study, going hand in hand with the mechanical design. Selection of relays and fuses to follow.
- Mechanical design: cells of a general dimensions (subject to change) were stacked together on CAD. Iterations for accommodating cooling arrangements and AMS slaves going on at the moment.



CAD assembly of an accumulator module

kWh	1 lap	22 laps	30 laps
germany	0.3075	6.765	9.225
michigan	0.26	5.72	7.8
australia	0.176	3.872	5.28
Avg.	0.247	5.45	7.44

Energy estimates for various FS endurance tracks calculated from OptimumLap

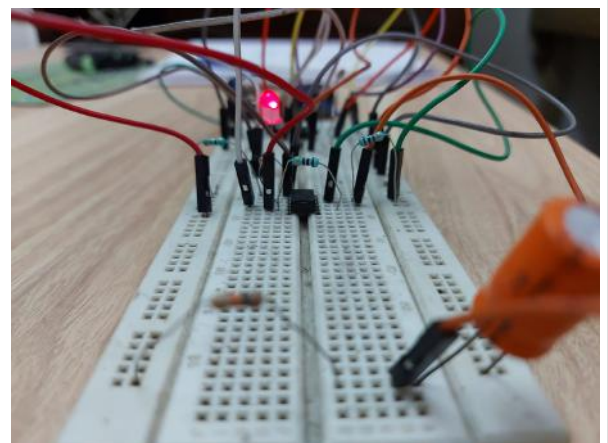
Cell data [SLPB81A6213]										
$V_{cell, max}$	4.2 V	$Cap_{cell, nom}$	21 Ah	$I_{cell, cont, max}$	200 A	$M_{cell}$	409 g (max)	Dimensions	189*89.5*10.7	
$V_{cell, nom}$	3.7 V	$Cap_{cell, min}$	16.8 Ah	$I_{cell, pulse, max}$	200	Internal resistance	0.6 mOhm max	Dist. b/w tabs	35	
$V_{cell, min}$	3.2 V					Max Discharge Temp	60 C	Tab dimensions	10*25*0.2	

S.no	N <sub>cell</sub>	V <sub>acc, max</sub> (V)	V <sub>acc, nom</sub> (V)	V <sub>acc, min</sub> (V)	Cap <sub>acc, max</sub> (kWh)	Cap <sub>acc, nom</sub> (kWh)	Cap <sub>acc, min</sub> (kWh)	M <sub>acc</sub> (kg)	I <sub>acc, max</sub> (A)	P <sub>acc, out, cont</sub> (kW)	Heat <sub>tot, max</sub> (W)
1	80	336	296	256	7.056	6.216	4.3008	32.72	231.25	59.2	32.0859375
2	85	357	314.5	272	7.497	6.6045	4.5696	34.765	231.25	62.9	32.0859375
3	90	378	333	288	7.938	6.993	4.8384	36.81	231.25	66.6	32.0859375
4	95	399	351.5	304	8.379	7.3815	5.1072	38.855	231.25	70.3	32.0859375
5	100	420	370	320	8.82	7.77	5.376	40.9	231.25	74	32.0859375
6	105	441	388.5	336	9.261	8.1585	5.6448	42.945	231.25	77.7	32.0859375
7	110	462	407	352	9.702	8.547	5.9136	44.99	231.25	81.4	32.0859375
8	115	483	425.5	368	10.143	8.9355	6.1824	47.035	231.25	85.1	32.0859375
9	120	504	444	384	10.584	9.324	6.4512	49.08	231.25	88.8	32.0859375
10	125	525	462.5	400	11.025	9.7125	6.72	51.125	231.25	92.5	32.0859375
11	130	546	481	416	11.466	10.101	6.9888	53.17	231.25	96.2	32.0859375

Excell tool developed for cell selection.

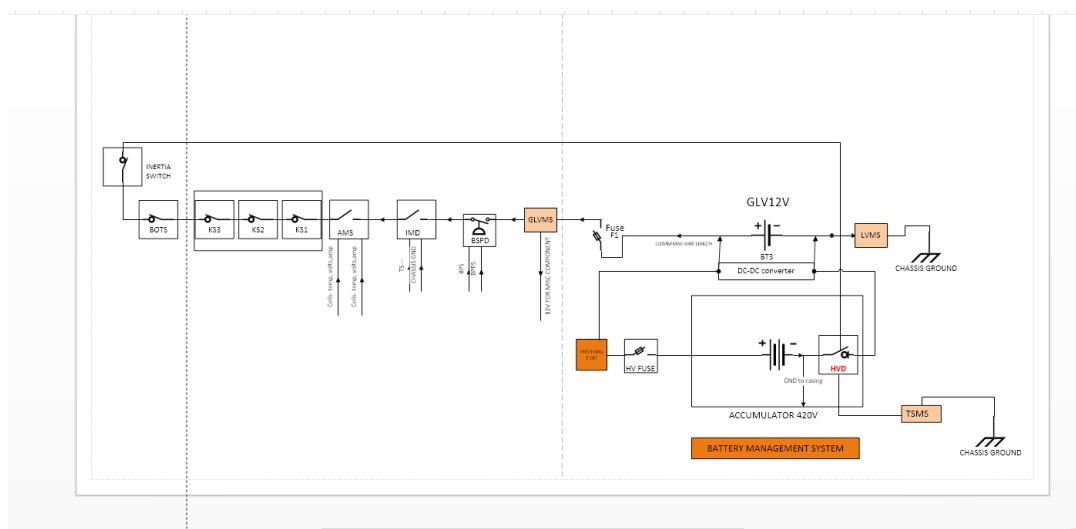
- Electrical design: First drafts for pre-charge and discharge circuits are ready, discussion regarding finalizing the design and simulations are on-going; a breadboard miniature of the TSAL circuit was created by one of the members.
- The department is also looking into all possible failure modes and their causes and remedies regarding every little component to ensure safety, apart from completing the FMEA report.



Miniature TSAL circuit.

## •Low Voltage System

- The department has studied about the shutdown system for the EV, which is a very critical subsystem on the vehicle, responsible for ensuring the safety of the as it is used to switch-off the tractive system in case of any error due to a subsystem.
- The department has looked into working of VCU and done market research on the same. It has been decided that a microcontroller would be used alongside the motor controller, to fulfil the purposes of the Vehicle control unit.
- Electric wiring for the whole car is underway, including all low voltage, high voltage and signal wires.



*LVS wiring diagram in progress*

## •Procurement Strategy

- Since the beginning of this month, the department has been working in tandem with the other newly created departments for the electric vehicle. Relentless search is being undertaken for the parts/items the other departments require. Owing to the lockdown and the subsequent freezing of all administrative work, final orders cannot be placed and thus this time is being optimally utilised for the comparison of quotations, which have been called for by the team from companies across the spectrum, in order to strike the best possible specs vs price balance.
- Procurement strategy of various items, for both Combustion Vehicle and Electric Vehicle, is being streamlined using spreadsheets and Gantt charts in order to ensure a more systematic approach to acquire parts/services from local vendors and various companies.

# MEET YOUR MEMBER



**J.S. Sandeep**  
**A.K.A Tanjeel Bhai**  
**Automotive - 3rd yr.**  
**VD Lead**

Yo!

*I joined TDR in my second semester thinking that it will somewhat help me utilise my time better having realised that I hadn't done anything satisfying in my first semester.*

*Well the team helped me with more than that.*

*I was first influenced by Tushar sir whose massive database was enough to have hour long talks about VD and cars in general. It was with him that I saw my first grand prix ever and boy o boy it was hell of a race(German gp 2018, the race when ham went p17 to P1 and seb crashed). This was enough motivation for me to learn more about Vehicle dynamics and aerodynamics.*

*TDR has helped me push my mental and physical limits. I will deeply cherish the moments when the vd department would stay for whole nights and sleep for just six hours and then get back to work straight-away. Although I won't recommend anyone in the team doing this now but these were the moments which made my seniors and juniors turn from colleagues to dear comrades.*

*For the juniors I would say that TDR gives you a lot of exposure through domestic and international competitions and helps in multi faceted growth of your personality. So don't miss this opportunity and enjoy the moments and HAPPY RACING!*



# ROLLING BACK THE DAYS



## Pranshu Pant Batch of 2018

Pursuing Master's degree in  
Mechanical Engg. at CMU

Being a massive F1 fan I was really eager to join the team the moment I heard about it. To work on such projects was exactly the reason why I had taken up Mechanical Engineering. So, I joined the team in my first semester thinking that it would be a great little side project. **Little did I know that it would become such an integral**

**part of my college experience and life in general.**

Due to the time commitment demanded by this project, initiation within the team felt a bit daunting at times but believe me that was the hardest phase. Once I began taking up responsibilities and started accomplishing my goals it started off a positive feedback loop and I found myself being drawn towards WindT. I still remember the first time I saw the fully completed chassis, a project that I had worked on for months. **The feeling of accomplishment after seeing the product of all your hard work is surreal and undeniably addictive.** Needless to say, I was hooked after that and I wanted to be a part of every project within the team.

For the current team, I would urge you guys **not to mindlessly focus on getting things done rather try to understand the why behind it.** Question everything, challenge all assumptions, even if they have been made by your seniors. Improving the car and the team is an iterative process. So, don't repeat your seniors' mistakes and try not to re-invent the wheel every year and you are bound to make progress.

Furthermore, don't let your personal squabbles hinder the progress of the team. Those matters will seem trivial and inconsequential in hindsight. To quote one of my seniors who aptly summarised this. "We are known as **TEAM** Defianz Racing, not Defianz Racing. Always remember that". **Remember that the joy of lifting the trophy is far greater than winning the small ego battles.**

Spending countless hours and sleepless nights developing the car might seem too cumbersome upfront but watching the car run at the competition will make all the effort worth it.

***So, buckle up and brace yourself for what is guaranteed to be the ride of your lives.***

# MOTORSPORT BUZZ

*Our little effort into bringing you the highlights from the world of motorsports.*

## FORMULA 1

The month of May saw some major changes on the 2021 F1 driver roster with the most shocking news coming from Ferrari as the Prancing horse declared that they would **not be extending Sebastian Vettel's contract beyond 2020**. Vettel's seat is to be taken by **Carlos Sainz**, who would leave McLaren in 2021 to join Charles LeClerc at Ferrari.

McLaren also had a few major updates to add to the shock, with **Daniel Ricciardo set to leave Renault post 2020** and take up Sainz's seat to drive along with Lando Norris in 2021.

**Vettel's future** remains largely unknown as of yet, with speculated moves to Red Bull, Renault or the new



Aston Martin racing team which is to replace Racing point F1 team.

More recently, **Renault declared that it will wait until after the 2020** Formula 1 season has started before it decides on who it wants to replace Daniel Ricciardo for next season.

In other news, the virtual E-prix series is underway in full swing with the Williams Formula 1 driver **George Russell dominating the latest Virtual Grand Prix at Monaco** to take his second successive win in the series by 39 seconds.

Also, the Formula 1 teams have approved a radical set of rule changes aimed at securing the future of the sport in the wake of the coronavirus pandemic.

Multiple sources have confirmed that teams supported the changes, which included **F1's budget cap being cut from \$175 million to \$145 million next year** and other rules including an aero development handicap system and the use of open source parts.

## MOTO GP

The 2020 MotoGP season is due to get under way with July 19's **Spanish Grand Prix at Jerez**. Due to the ongoing COVID-19 pandemic Dorna Sports has put in place several security measures to reduce the risk of spreading the coronavirus. One of those measures is to reduce the number of team personnel in the paddock. That means the current wildcard system will be scrapped for MotoGP, Moto2 and Moto3.

On the other side, It was an absolute treat for the MotoGP fans as the three-time MotoGP world champion **Jorge Lorenzo**, who had retired from racing at the end of last year, is all set to make his **Esports debut on Sunday for MotoGP's latest Virtual GP**, which will be staged at Silverstone and feature the Moto2 and Moto3 classes.



*In photo: Spanish MOTO GP driver  
Jorge Lorenzo*

## FORMULA E

In an official statement from the organisers, it has been stated that the **current Formula E season will be scrapped if there are no more races before October** to ensure the full 2020-21 calendar occurs when the series gains world championship status.

Further according to championship chairman Alejandro Agag, Formula E could **abandon city-centre circuits for up to three years** as a result of the coronavirus pandemic and move to permanent circuits and stage races behind closed doors.



*In photo: German driver Daniel Abt*

There was some drama in the E-sports series as Audi Formula E driver **Daniel Abt** has been disqualified from the latest Formula E Race at Home Challenge race, stripped of his points total and handed a €10,000 fine over allegations of cheating. Abt, who originally finished third in the fifth round of Formula E's sim racing series on Saturday at a virtual Berlin, **was found to have let a professional esports racer control his virtual car for the race.**



# World Endurance Championship

Several FIA World Endurance Championship teams are **calling for fewer races** in 2021 in the face of the economic fallout from the global coronavirus pandemic.

Entrants relying on paying drivers believe that a regular eight-race schedule will not be economically feasible as recession bites amid the COVID-19 crisis.

Also, it has been announced that a **virtual Le Mans 24 Hours** will be staged on the original 13/14 June date of the race prior to its postponement to September by the coronavirus pandemic.

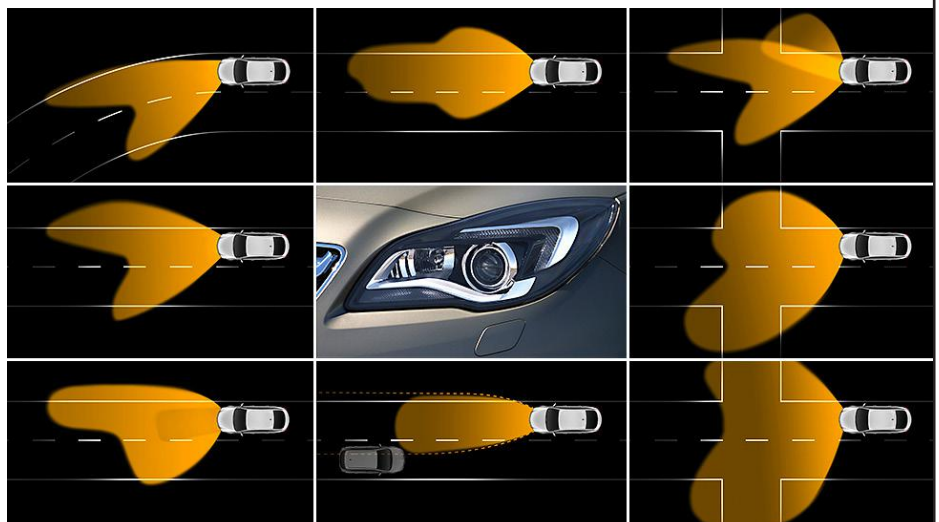


## TERRIFIC INNOVATIONS

### INTELLIGENT AUTOMOTIVE HEADLIGHTS

With the improvement of people's consumption ability and the rapid development of science and technology, more and more people pay attention to the driving safety and environmental protection of vehicles. As one of the important parts of future automobile driving plan, headlamp is also invested by more and more automobile companies and research institutions. The aim is to come up with **headlights that are brighter, have a longer range and are smaller, more energy efficient, intelligent and digital.**

The latest innovation to slowly make its way into the popular automotive market is the Intelligent Headlight Control technology. The intelligent headlight control **uses a video camera to measure the ambient brightness** and to estimate the distance from vehicles in front and oncoming traffic. This data is used to implement a variety of light functions.

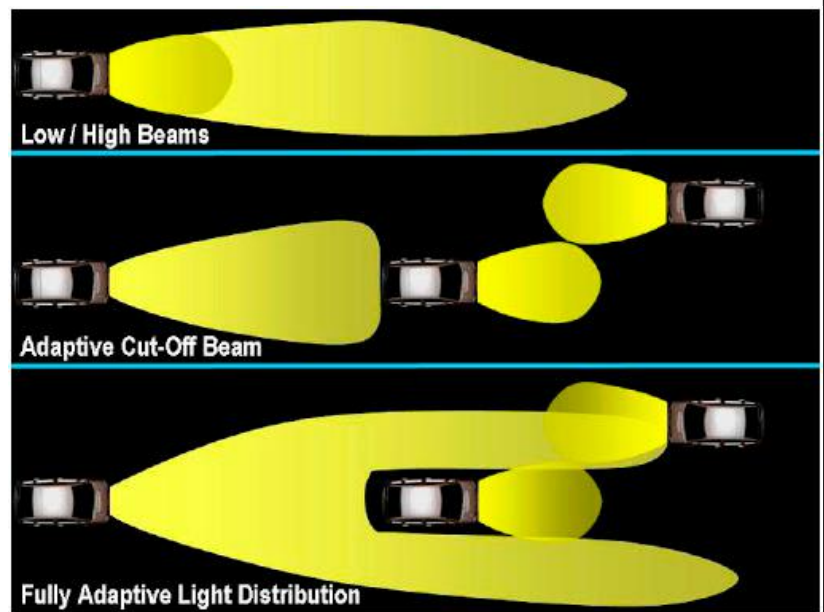


**The low beam activation function can automatically activate or deactivate** the vehicle's low beam lights in accordance with the current lighting conditions. High beam control improves driver visibility at night by automatically controlling the on/off function of the vehicle high beams through traffic detection.

Using video data, the range of the low beam or high beam lights can also be automatically adjusted. **The adaptive high beam control not only controls the range** or segmentation of the light, **but also the width of the beam** according to traffic conditions.

This can illuminate curves in advance or a wider light cone, which can effectively illuminate the edges of the road in urban areas, ultimately **helping the driver to spot any potentially vulnerable pedestrians**.

With continuous high beam control, the **driver can leave the high beam on continuously without disturbing other vehicles**. It uses headlights that are swivel-mounted horizontally and vertically or full LED headlights in which the entire light distribution is controlled in segments so that **road users who could potentially be distracted are not exposed to the light** cone while the remainder of the area can be optimally illuminated by the high beam. The light distribution



from the high beams remain virtually unchanged for opposing vehicles, **while the drivers visual range is considerably increased**. To ensure that other road users are not blinded, a control device switches off specific individual light points or regulates their brightness. This way, the windscreens of oncoming vehicles in particular are avoided. The length and distribution of the light beam automatically adapt to the traffic situation.

## SYSTEM BENEFITS FOR DRIVERS

- Ensures optimum illumination of the road
- Enhanced vision for the driver
- Less nuisance to oncoming traffic and vehicles driving ahead
- Makes driving at night an altogether safer and more comfortable experience

## SYSTEM BENEFITS FOR MANUFACTURERS

- Detects other road users and measures their distance for an optimized headlight control
- Enhances driving safety for all road users
- Enables the application of various light functions

# DEEP DIVE - GEARBOX

A car's transmission is among its most vital elements. It connects the engine to the drivetrain and governs how much power you use from moment to moment. Internal-combustion engines run at high speeds, so a **reduction in gearing is necessary to transmit power to the drive wheels**, which turn much more slowly.

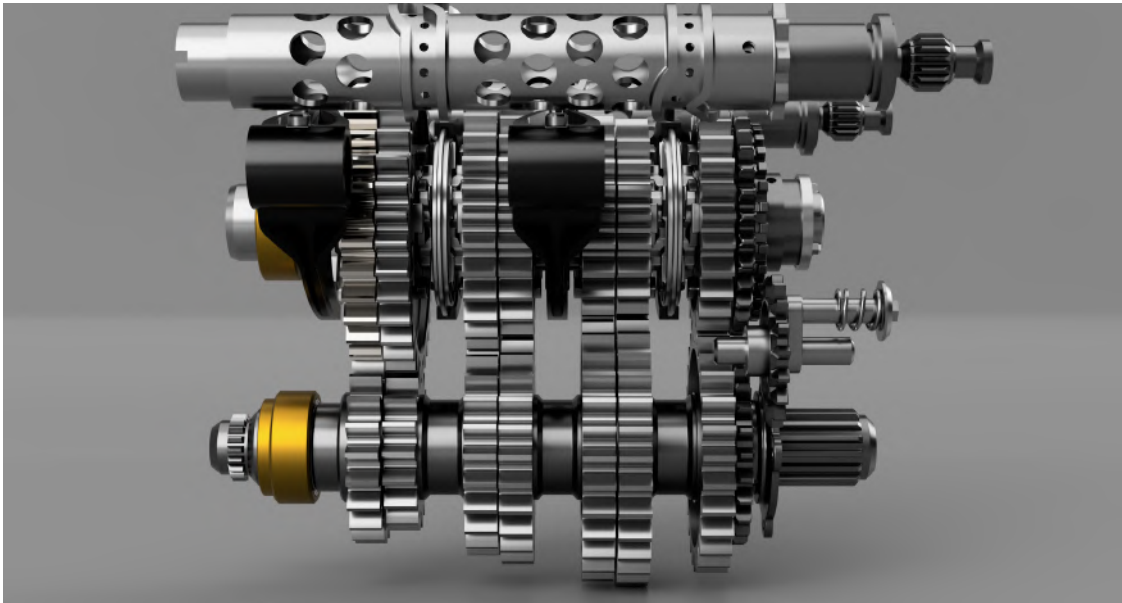
The gearbox is the **second stage in the transmission system, after the clutch**. It is usually bolted to the rear of the engine, with the clutch between them.



*Gearbox from a toyota passenger car.*

The transmission housing contains three shafts interacting with one another. One of them is attached to the **engine (the input shaft)**, one is attached to the **differential (the output shaft)**, and the third shaft, often called the **lay-shaft or the countershaft**, interacts with the other two via a system of gears.

While the car is on, the engine shaft is always turning, even while the car is idling.



*Model of an F1 gearbox featuring a sequential shifting system.*

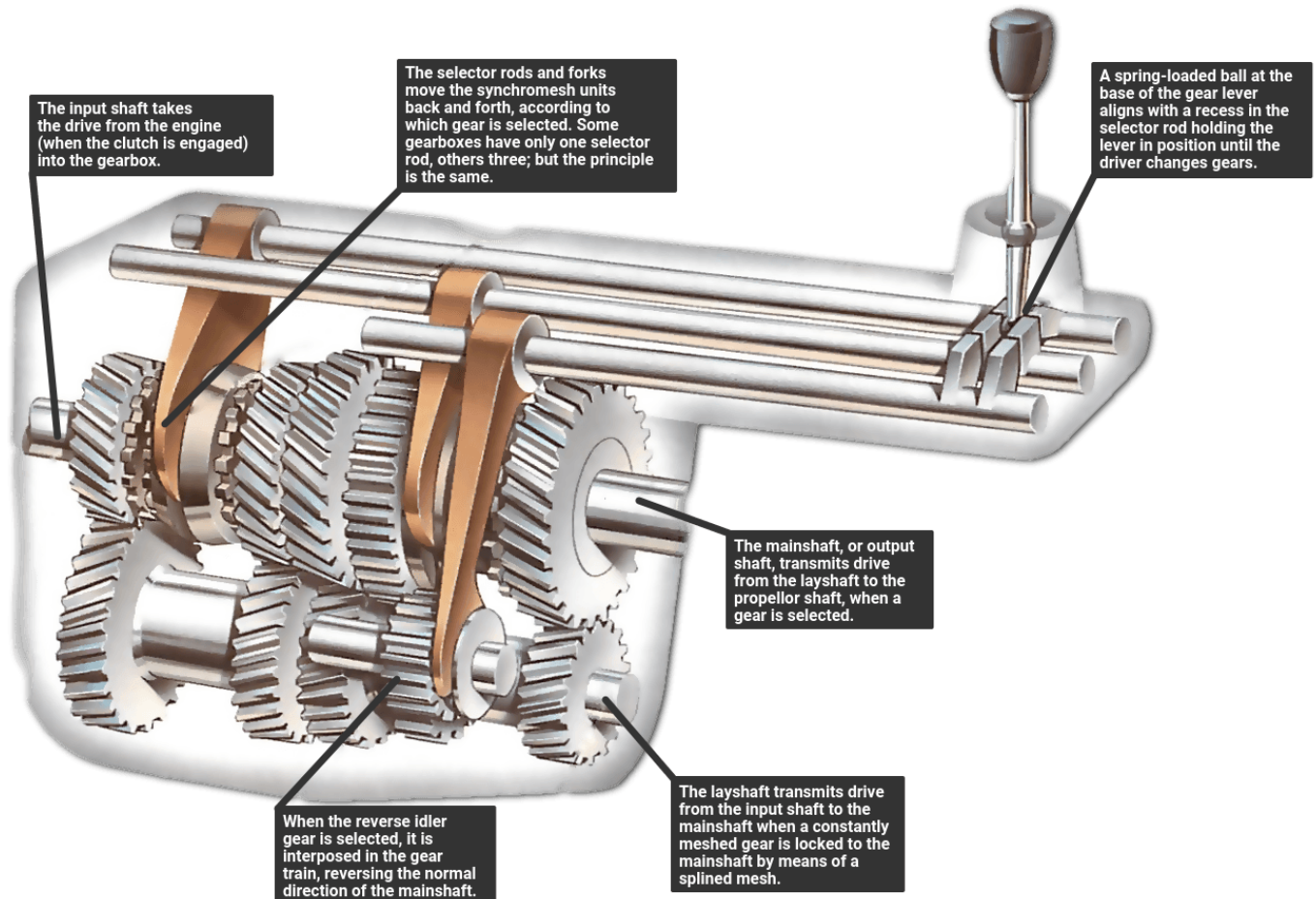
**When the the clutch pedal is stepped on, the friction clutch is activated**, which is situated between the engine's flywheel and the input shaft. The purpose of the clutch is to **decouple the engine from the transmission**. This is what enables the change in gears. The gearbox provides a selection of gears for different driving conditions: standing start, climbing a hill, or cruising on level surfaces. Modern cars with manual transmissions have four or five forward speeds and one reverse, as well as a neutral position.

**The gear shifter is responsible for physically engaging the gears** on the output shaft, locking them in place so that they turn the shaft and send torque to the drive wheels.



**The engine drives the input shaft**, which drives the layshaft. The layshaft rotates the gears on the main shaft, but these rotate freely until they are locked by means of the synchromesh device, which is splined to the shaft. **It is the synchromesh device which is actually operated by the driver**, through a selector rod with a fork on it which moves the synchromesh to engage the gear.

**The baulk ring, a delaying device in the synchromesh**, is the final refinement in the modern gearbox. It prevents engagement of a gear until the shaft speeds are synchronised.



On some cars an additional gear, called **overdrive**, is fitted. It is higher than top gear and so gives economic driving at cruising speeds.

**So, to summarise, this is why a gearbox is an absolutely essential component of your combustion vehicle:**

- Its main function is to vary the torque and speed according to the driver's need.
- When the vehicle encounters a bump or a speed breaker then at that time, the vehicle's speed is slowed down by the application of breaks so more torque is required to pick-up the vehicle otherwise it will stop due to low torque. Which is why the gear is shifted from higher to lower to get the required amount of torque
- Without the gear the vehicle can't be driven in reverse direction.

# OUR PRECIOUS SPONSORS

## FEATURED SPONSOR

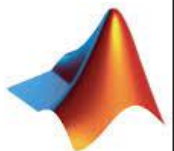


## COOL DOWN, KIDS!

We welcome **C&R RACING** on board for providing us an amazing **RADIATOR** apartments for their projects. from technical help and amazing service.

C&R racing is the supplier of choice for cooling solutions used by leaders in motorports industry. Founded in 1988, C&R Racing, Inc. started as a specialty machine and fabrication shop serving the **IndyCar Industry**.

Today C&R supports competitive race teams, major automotive companies that manufacture niche performance vehicles, industrial vehicle fleets, specialized military requests and car enthusiasts who want the very best compo-



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