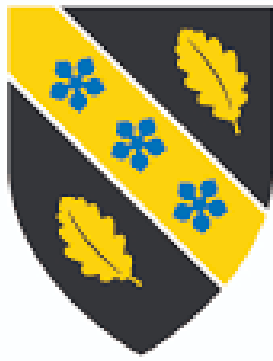


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A Summary of 8 chosen topics that have affected the final development of the 2021 Koenigsegg Jesko Absolut.

Introduction to Automotive Engineering (ACHA4009)

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1. Introduction

This report will contain research and factual information that has been accumulated about the Koenigsegg Jesko Absolut. The focus of this report is to understand and acknowledge the process Koenigsegg use to design, test, and produce each vehicle and how the company is evolving over time. The research will focus on certain topics that have been implemented in the manufacturing procedure from start to finish of the Koenigsegg Jesko Absolut.



Figure 1&2 shows design of the Koenigsegg Jesko Absolut

2. Effects of the following topics

2.1. Materials.

The components of the Jesko are of the highest standard with no expenses spared, Due to this factor certain elements of the Jesko have been formed using unique materials. Firstly, the impressive twin turbo 5 litre V8 engine that possesses an eye watering 1280hp on standard fuel or 1600hp on E85 as stated by (Jesko – Koenigsegg, 2021) is an automotive engineering feat. The engine is built with an array of different materials, the engine block is formed using aluminium while the intake manifold is carefully constructed out of carbon fibre. These materials were chosen due to them being incredibly light and durable. Another mentionable component of the Jesko's engine is the remarkable V8 crankshaft, this is no ordinary crankshaft however as it has a weight of just 12.5 kilos making it the lightest in the world and is made using a single steel billet. Finally, the connecting rods are formed using premium steel and weigh just 540g while the aluminium alloy pistons which also has a ceramic coating on the face to prevent hot spots has a respectable weight of 290g for each piston. Due to all these lightweight materials being used the total weight of the Jesko's engine is a remarkable 189kg

Although much is not known about the chassis of the Jesko it is understood that Koenigsegg use a pre-impregnated carbon-fibre design that also consists of an aluminium honeycomb core structure as agreed with (Ali and Vorasuntharoso, 2014a). This material combination provides a very lightweight feature while also keeping the car within safety regulations as stated by (Feraboli, Masini and Bonfatti, 2007). Finally, arguably the most intriguing material used on the chassis is located at the rollover bars which are produced using high-performance Dyneema composite fabric. This material has a superior-strength, while still maintaining low-weight characteristics.

With all these impressive attributes it is important to not neglect the suspension and steering of the vehicle and Koenigsegg does not disappoint. Since 2010 Koenigsegg have used an inhouse system called the triplex suspension system, a third horizontal damper was added at the rear as well as the front to counter an ongoing issue where the rear of the car dropped under acceleration as highlighted by (Jesko – Koenigsegg, 2021). The vehicle suspension is well equipped for any situation and as a result many different materials were used such as the car having carbon fibre rear upper wishbones as well as having an electronically adjusted gas-hydraulic shock absorber. The Jesko wheels come in two different materials one being forged aluminium or the greater being a carbon fibre option. As with all high-end vehicles the interior of the Jesko contains a few exotic materials such as leather, Alcantara and carbon fibre used to provide the customer with the best of comfort. – (Kerry Tudor, 20th January, 2022)

2.2. Manufacturing.

As with most supercar companies they neglect to state the manufacturing process as rivals can potentially use this to their advantage however Koenigsegg take pride in the vehicle manufacturing process and as a result certain parts of the vehicle can be tracked. To begin the connecting rods were designed by Dr. Thomas Johansson who is employed as an engine architect at Koenigsegg. The one-of-a-kind crankshaft is milled by a small manufacturing house located in southern Sweden unfortunately the company name is unlisted. Finally, the head of the engine is produced by f1 specialists Grainger and Worrall. Koenigsegg have made it a company goal to construct as much of the vehicle as possible independently, as a result of their effort the following parts and elements are all designed with the majority being constructed in-house and agreed by (Ali and Vorasuntharoth, 2014b)

To begin the impressive 9-speed multi-clutch transmission is 100% designed and built in-house. Furthermore, the air core carbon fibre wheels, triplex suspension system, rocket cat catalytic converter are all designed in the facilities of Koenigsegg. All software such as the traction and stability control programmes as well as the smart cluster, smartcenter and smart wheel are all developed by Koenigsegg with technical assistance from Qt professionals also within the Koenigsegg facilities. Lastly, the adjustable dampers are manufactured by Swedish specialists Öhlins, the dampers are then modified with performance electronics at the Koenigsegg facility.

The Koenigsegg headquarters located in Ängelholm contains the following facilities allowing the company to develop their in-house design and build success. The facilities include an engine and testing area as well as a paint shop, research and development section, pre-and final assembly halls and vehicle parts and storage. The Koenigsegg factory was built on an abandoned airfield and as a result the company are able to run critical testing on their 1.7km racetrack that previously was a runway for jets. Over the years due to their dedication on being more independent Koenigsegg has greatly reduced the number of components produced by other manufacturers, The 2007 Koenigsegg ccx engine was approximately 20-25% ford parts however, the Jesko engine has only around 5% ford components used on it. The final production number for the Koenigsegg Jesko is 125 units. - (Kerry Tudor, 3rd February 2022.



Figure 3 showing inside the Koenigsegg factory and construction of vehicle

2.3. Aerodynamics

When designing the Jesko Absolut the company decided that they wanted a more road-based vehicle than a track car and as a result the designers made a few notable differences to the Absolut compared to the original Jesko. Firstly, the racing wing on the Jesko was removed decreasing the downforce from 1400kg to just 150kg as agreed with (Jesko – Koenigsegg, 2021) to assist with high-speed stability, as agreed by (Nath *et al.*, 2021), two fins were fitted to the rear hood of the vehicle. The Absolut was also elongated forming a tear-drop shape to also help reduce drag as well as the front-splitter and winglets being removed from the car entirely. The drag coefficient for the Absolut is just 0.278cd making it not as track focused as the original Jesko. – (Tim Tudor, 17th February, 2022

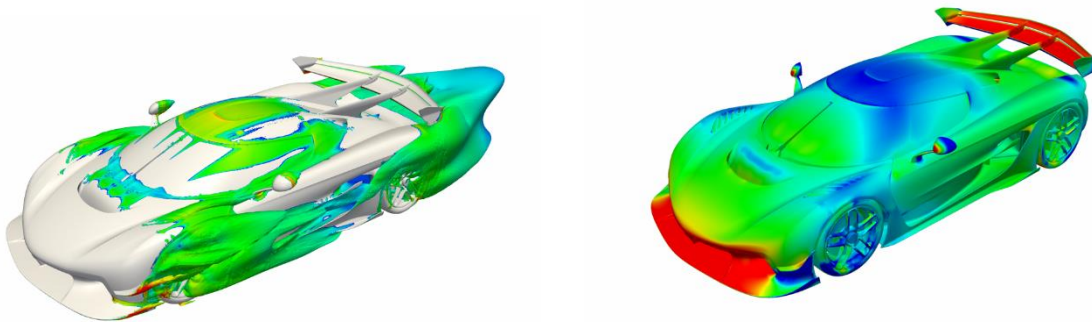


Figure 4&5: CFD images of the track model Jesko highlighting airflow (Jesko – Koenigsegg, 2020)

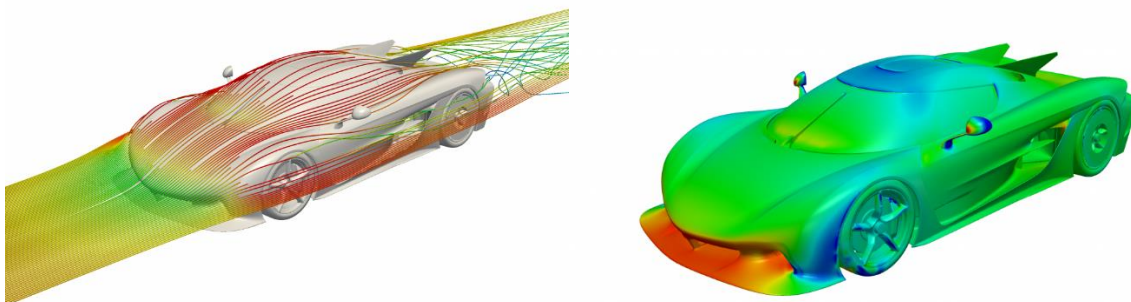


Figure 6&7: CFD images of remodelled Jesko Absolut highlighting airflow. (Jesko – Koenigsegg, 2021)

2.4. Emissions.

Koenigsegg has a passion on reducing greenhouse gases and dedicate a substantial amount of their team with the goal of reducing the emissions on their vehicles. The company developed a newly designed catalytic converter called the rocket cat, this system works by using a pre-cat to build up pressure and at high rpm any over pressure is detoured immediately to the main catalytic converter, this design was Koenigsegg's first patent as stated by (*How Koenigsegg's Clever Catalytic Converters Work*, august 2019 a). The car's engine is fitted with tumble intake valves these valves cause turbulent air which results in a faster burn rate causing an end result of a more efficient and effective combustion leading to reduced emissions. The Jesko is also equipped with an air injection system that reduces the time taken for the catalytic converter to reach operating temperature and allows the catalytic converters to function on start up. This system has been described by Koenigsegg as an "important emissions reduction measure". Finally, the Jesko also contains the world's first individual pressure sensor in each cylinder allowing the engine management system to examine and control each cylinder at maximum efficiency as agreed with (Jesko Model Information - Koenigsegg Boston, no date), which reduces unburnt fuel. Unfortunately, no emission data can be found on the Jesko however it is confirmed the Jesko Absolut meets Euro 6 requirements. – (Abigail summerfield, 10th February, 2022

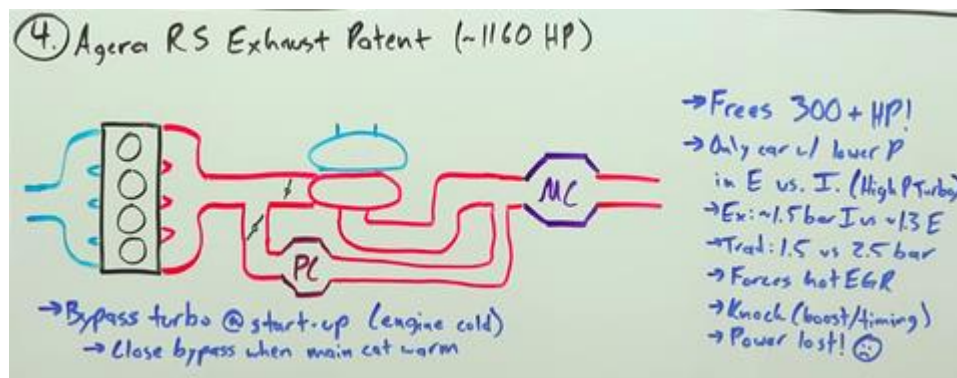


Figure 8: Diagram showing similar exhaust system used on the Jesko (How Koenigsegg's Clever Catalytic Converters Work, August, 2019)

2.5. Computational methods

Koenigsegg, did not release any data except from the CFD figures inserted on page 6 however, the company claims to have accumulated 3000hours studying CFD results and below are the purposes Koenigsegg would have used this data for. Firstly, the Jesko Absolut costs the customer around 2.3 million to purchase, Koenigsegg relies on CFD so they can get a clearer understanding of expenses before building the cars. The designers are also able to alter the design of the components to meet necessary requirements. However, the main purpose of using CFD is to monitor fluid flow all through the vehicle, the designers will be able to monitor the flow of fluids throughout the engine such as water, oil and fuel. On the outside of the vehicle the flow of air can be monitored highlighting specifics such as where drag is occurring on the vehicle. Finally, it is also claimed and supported by (*Koenigsegg Jesko Absolut – In The Name Of Speed - Motor Illustrated*, no date) that over 5000hours was dedicated for the design of the Jesko Absolut. Within the 5000hours consumed the designers would have tested many various designs before coming to what they believe as the most ideal design. Another form of data analysis that is used is the engine management system controlled by CAN. - (Andrew Noble, 17th March,2022)

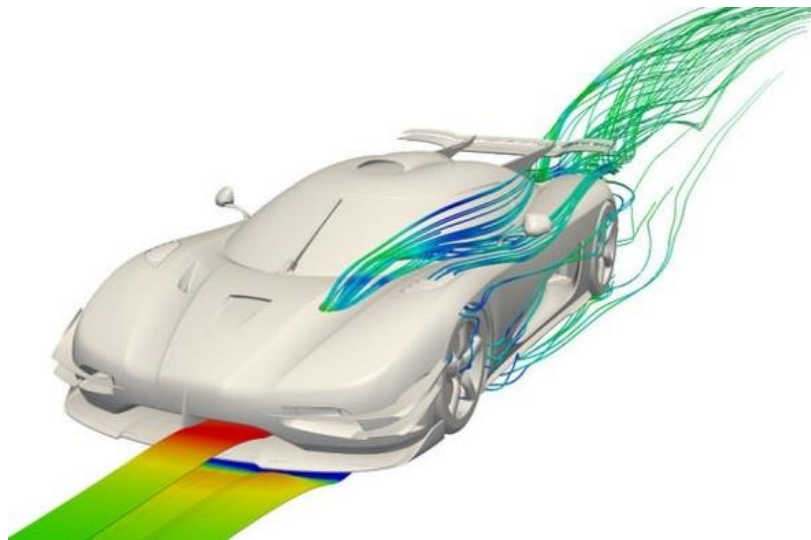


Figure 9: An example which shows how CFD would have been used to design the Jesko Absolut(Koenigsegg Agera One:1 makes its debut in Geneva | Drive Arabia,2015)

2.6. Control systems/Data acquisition

Koenigsegg has fitted the most up to date electronic control systems to the Jesko Absolut, these systems have a variety of purpose however the main objective is to provide performance, safety and comfort. To begin, the vehicle is fitted with a high-performance smart cluster this component allows for key features such as an LCD screen that displays the vehicles speed, oil levels and allows any other electrical feature to work, however unlike a basic cluster the smart cluster is able to acknowledge vehicle data and self-diagnose issues with the vehicle. A feature named Koenigsegg Electronic stability has been fitted to every Koenigsegg since 2011, this system provides stability at high speeds and does not allow the vehicle's wheels to jerk left or right at high speeds. Finally, the electronic stability control and traction controls allow the driver to alter the cars behaviour during different scenarios such as in the rain or attending a track day. – (Andrew Gibson 11th March,2022) (Andrew Harrison 3rd March,2022)

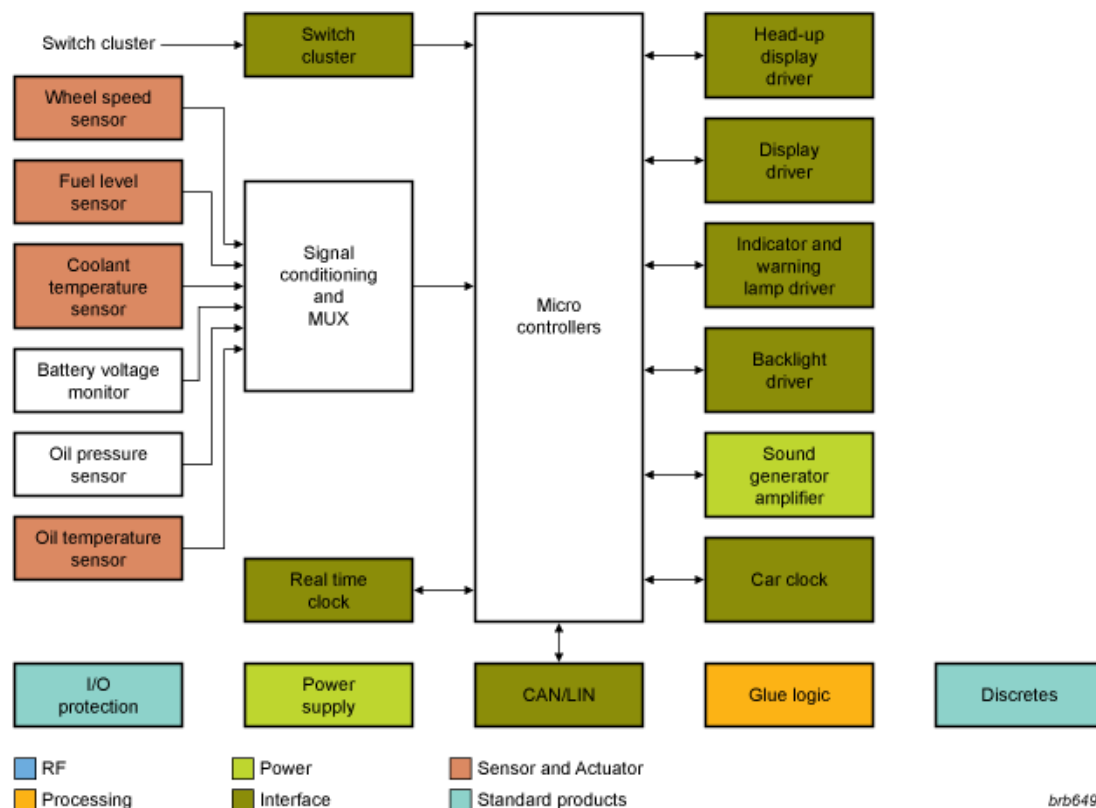


Figure 10: Basic automotive cluster diagram(NXP's automotive instrument cluster block diagram - Electronic Products, 2018)

2.7. Dynamics/Kinematics

The dynamics of the Jesko Absolut are one of a kind, Firstly the car is equipped with the longest front and rear wishbones ever used on a car the company also decided to improve the vehicles responsiveness and stability by using enlarged wheel bearings. Additionally, the vehicle's dampers are fully adjustable for bump and rebound damping, the spring ration and the ride height are also able to be adjusted and can be altered on the steering wheel. Koenigsegg altered the suspension set up on the Absolut to aim for higher speeds and less downforce. Finally, to ensure the best performance of this vehicle both the rear and the front of the vehicle are supplied with Koenigsegg's Triplex damper system. – (Owen Williams,24th February,2022)

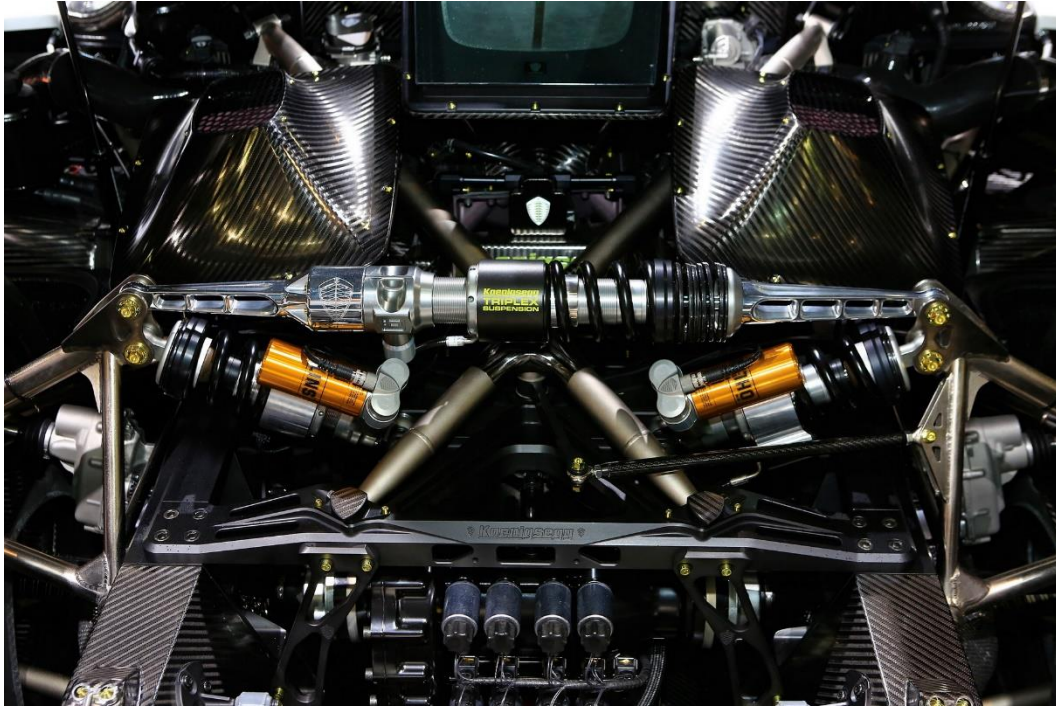


Figure 11: Koenigsegg's Triplex suspension system (Koenigsegg Stuns The World With New 300MPH Jesko Hypercar | Carscoops, March 6,2019)

3. Conclusion.

In conclusion this paper contains all the information that shows exactly how the Koenigsegg Jesko Absolut is constructed for the customer, The paper also shows how the individual topics listed above impact the process of the vehicle from choosing the ideal raw materials to the final stages such as interior options and design.

4. State of industry.

In today's automotive industry the Koenigsegg Jesko Absolut has a particular place within the industry. The vehicle is equipped with the newest technologies which other vehicle companies will be trying to replicate for years to come. The Absolut also highlights the forever growing desire for a faster vehicle. However, with a price tag of £2,625,00 the Koenigsegg Absolut's place in the industry is defined as a luxury supercar where only the richest can afford. Being a newly developed vehicle, the Absolut is compliant with all road legal requirements such as Euro 6. Finally, the Absolut lies within a competitive super car market rivalling companies such as Bugatti.

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