DVN-I
Automotive Interior

Thu, 29 July 2021 Weekly Newsletter **NEWSLETTER #71**

Editorial

DMS Session At September DVN Workshop

DVN & DVN-I WORKSHOP WITH DRIVER MONITORING SYSTEM

This coming 21-22 September will be the DVN Workshop near Detroit in Novi, Michigan—a real, live, face-to-face event with acclaimed speakers and a large spread of expo booths. The rubric of the workshop is *How to Save Lives in Nighttime Driving*, with topics including Driving Monitoring Systems (DMS), ADB, LED, MicroLED, lighting performance assessment, simulation, testing, measurements, and regulation. As DMS is expected to be mandatory by 2022-'24, this DVN Workshop will be a grand opportunity to get up to speed on DMS technology, technique, and innovations. Don't miss it, register here.

The trend to buttonless operational elements can no longer be stopped. Therefore we give a deeper insight into the evolution of touch technologies with haptical feedback and voice interface. Fa. Ansys presents to the topic DMS an In-Cabin Sensing System and simulation tool and Fa. Philips a car air purifier that eliminates viruses and bacteria with high efficiency.
In the Design Lounge Pininfarina introduces a concept BEV that showcases the creative potential in using a new BEV platform. It is an interpretation of fully electric, autonomous mobility with new user experience and technology.
Who remains the technology leader, will Air Taxis become reality and what about chip shortage and supply crisis? Please read this and more in our DVN-I Newsletter and enjoy it. We're glad you're in the DVN Interior community! (And if you aren't yet, **come join in**).

Sincerely yours,

Carsten Befelein
DVN-Interior Consultant

In Depth Interior Technology

The Evolution of Touch Technologies

IMAGE: TOYOTA

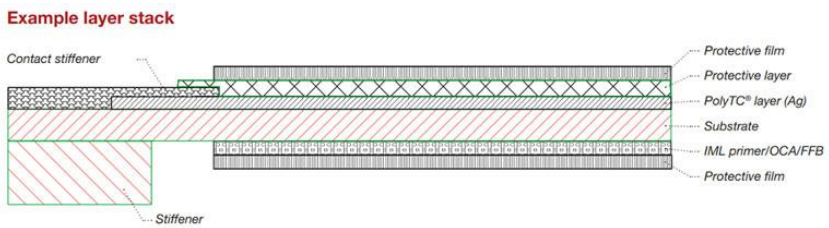
Touch displays are everywhere, as it seems. Smartphones, tablets, televisions… refrigerators, ovens, self-serve kiosks at airports, train stations, and grocery stores…bank machines…they're ubiquitous, and vehicles are gallopingly included. Touch screens mean buttonless operation of HVAC and infotainment systems and increasingly much more. In-car touch screens present challenges not present in other applications: punishing vibrations, repeated thermal cycling over a wide range of operating temperatures, and electromagnetic fields are on the list. To ensure drivers can enjoy the benefits of touch displays not only at home but also in their cars, the technology must be adapted to the requirements.

This is achieved with state-of-the-art technologies and rigourous, extensive testing and validation processes to assure durability and function. This way, the operating experience is actually enhanced and not degraded by advanced touch displays. And that is as it must be; drivers and even passengers have short patience and little tolerance for feeling as though the car's controls and displays are working against them rather than for them.

Capacitive sensors are used for touch displays due to their high reliability and wide range of functions. Panels in non-automotive applications are becoming thinner and lighter, but this poses a greater problem for vehicles. The sensitive sensor technology is subject to stricter requirements in terms of service life and environmental influences, which is why more robust displays have been developed—but at the expense of lightweight construction. Precise sensor technology is necessary in vehicles in order to provide the expected level of comfort in the vehicles of tomorrow. While high rigidity of components is important, touch displays should still be flexible enough in an accident to reduce the risk of injury in a collision. Therefore it is important to protect the sensors and the driver and to bring familiar features into the passenger compartment.

CAPACITIVE TOUCH SENSORS WITH TRANSPARENT AND CONDUCTIVE FILMS (IMAGE: POLYIC)

At the heart of every touch LCD display is the "cell", which essentially consists of a protective TFT (thin film transistor) glass layer on which TFT circuits are mounted. Above this is a layer of liquid crystals, which is closed at the top by a color filter and the corresponding glass layer. This entire element is enclosed by the polarization filter. The display is supplemented by a backlight, and protected at the top by a cover glass. The deeper the sensor technology is built into the cell, the more the surrounding components offer protection; a slimmer, thinner design becomes possible. When the electronics are applied to the outer layers (out-cell technology), they are more exposed to temperature fluctuations, vibration, and electromagnetic fields. As a result, manufacturers began to build the sensor and the microcontroller deeper and deeper into the panel (on-cell technology). The advantage of such a design is the basic structure of a touch component. Limiting the number of layers in the optical stack results in lower reflection and improved solar radiation without increasing the brightness of the backlight.



(IMAGE: POLYIC)

The out-cell design was common for the development of touch displays. Here, the display was connected to the sensor by a bonding process. The biggest advantage of this design is that any display technology preferred for the application can be used. For example, any commercially available touch sensor that meets the requirements can be combined with the display. However, this means that the sensor technology rests externally on the polarization filter, which makes the entire component thicker than is desired in consumer electronics.

To counteract this disadvantage of the out-cell design, the on-cell design was established as the next step. Here, the sensors within the display are mounted directly on the cell, which already provides potential for a thinner construction due to the integration. This trend toward thinner displays is reinforced in the automotive industry today with the complete integration thanks to the in-cell variant in combination with, for one example, Synaptics' TDDI (touch and display driver integration) technology. This approach allows sensors and even controllers to be moved right into the center of the display, where they are optimally protected. The advantages are a thinner module and improved optical quality. The production process itself is also accelerated by this design, since fewer production steps and suppliers are required for an in-cell display.

However, with the complete in-cell integration of sensor technology and controller, not all challenges related to touch displays in vehicles have yet been mastered. This is because many automobile manufacturers have very specific requirements. One of the most common demands is for a water-proof design, for example, where raindrops or condensation are recognized and ignored by an algorithm in the touch system software. Thanks to this technology, the system can be operated even in moist conditions without any unexpected behavior. Another oft-requested feature is a display that allows touch gestures even when passengers are wearing gloves; the details for such features vary from manufacturer to manufacturer and must therefore be tested and developed for the respective performance requirements.

In order to ensure smooth series production, reliable tests that meet the standards of objectivity, reliability and validity are already required during prototype construction. To this end, the respective test procedures should provide the same conditions for each component. At the automotive service provider ARRK Engineering in Munich, Germany, this is made possible by an internal department—the local test department for display and control systems. There, all customer requirements can be checked with the help of the comprehensive know-how of the experts for touch displays and extensive analysis and test equipment.
For example, automated endurance and stress tests can be used to check certain points in rapid succession in order to detect possible deviations on the entire touch surface and eliminate sources of error at an early stage. In addition, the use of standardized gloves with different materials makes it possible to test functions for different applications. ARRK can assist with selection of suppliers as well as provide technical and organizational support for the nomination process.
To increase driving pleasure, other trends for touch displays are also finding their way from household electronics into cars. For example, OLEDs (organic light-emitting diodes) are increasingly being used in vehicles, in which each individual pixel represents a light source. In conjunction with TDDI technology, OLEDs make it possible to develop curved and thin touch displays for manifold new designs.
Developments for haptic feedback are also being integrated into modern vehicle displays. Using different types of actuators, different parts of the display can be moved in the micrometer range. This gives the driver the feeling of actually pushing or turning a physical button. If this is supplemented with force sensing, different functions can be activated depending on the force of the fingers applied to the display.
As much as the automotive industry can learn from the use of touch displays in the entertainment industry, the reverse would also be possible. After all, the increased requirements with regard to heat, vibration and electromagnetic compatibility in vehicles also open up new possibilities for consumer electronics. A smartphone, for example, could benefit greatly from greater resistance despite thin and flexible components. This means that consumer electronics can also benefit from the latest developments in the field of touch displays in vehicles.

(IMAGE: TOYOTA)

Toyota will launch a new multimedia solution for their North American vehicles, developed by their own in-house Connected Technologies group. The corporate aim is to unify customer experience, in-vehicle technology, value chain, and connected revenue process —functions previously scattered across the organization.

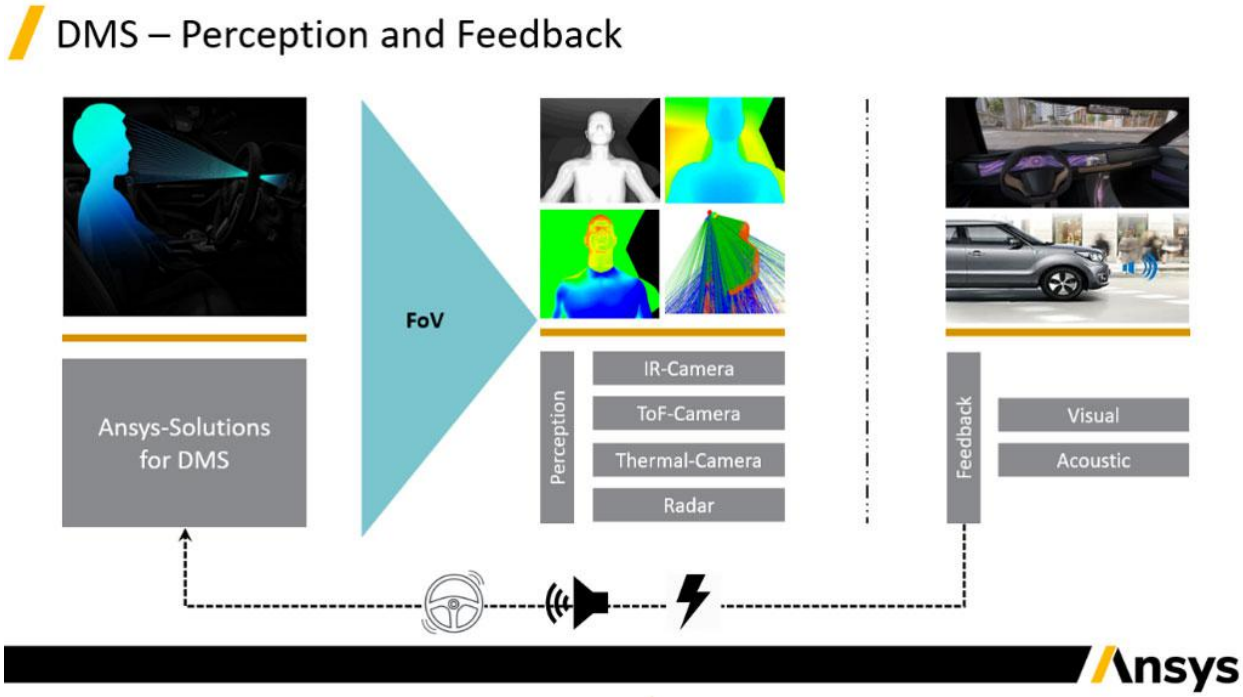
The human-machine interface (HMI) has benefitted from improvements in the graphical user interface (GUI) and voice interface. This, says Toyota, delivers a unified feeling and ease of use while balancing accessibility needs. Additionally, the voice interface is designed to use advanced graphics to distinguish between listening and processing states, and the appearance matches the new and improved capability of cloud processing.

The newly developed virtual assistant features dual microphones; enhanced noise cancellation and speaker locations; and seat detection capabilities, giving front-seat occupants expanded and interactive functionality to access navigation, media, phone, and vehicle settings.

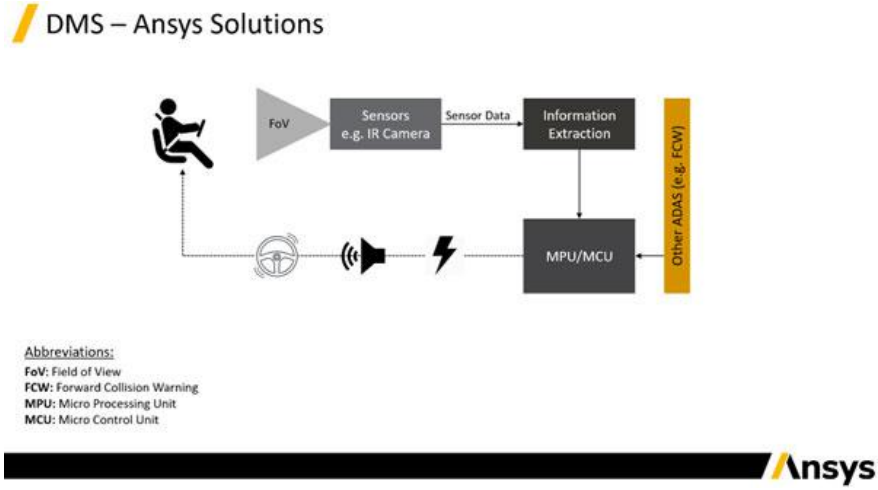
Interior News

In-Cabin Sensing Systems and Simulation with Ansys

INTERIOR NEWS



DMS (driver monitoring systems) and OMS (occupant monitoring systems) can be based on camera, radar, or other technologies. Regulators in major markets are introducing standards and requirements for in-cabin sensing systems; i.e., DMS and OMS. In February 2020, the U.S. National Transportation Safety Board recommended DMS as an effective means of driver engagement in L^2 vehicles. Euro NCAP recognized the importance of DMS in its revised crash-test safety standards, which—starting from 2020—require DMS for a five-star rating. The European Commission has decided a system actively monitoring driver condition and distraction will be mandatory for all new cars starting in 2026; this rule will be gradually phased in starting next year. DMS may combine advanced optical and electromagnetic sensors as well as AI algorithms to detect a driver's eye movement, facial feature movement, breathing, and other parameters. Complex systems such as these require rigorous testing and validation to attain the needful level of reliability and safety. Ansys supports the development, tests and validation of DMS, to minimize development time and cost.



Don’t miss the DMS session at the DVN Workshop this coming September 21-22 in Michigan; register **here**.

Philips Air Purifier Zaps Viruses, Bacteria

INTERIOR NEWS

PHILIPS GOPURE IN CUP HOLDER (IMAGE: PHILIPS)

The Philips GoPure Style GP5611 car air purifier, now being offered in Singapore for the equivalent of about USD $200 (€167) eliminates viruses, bacteria, and fine particulates within a car's cabin. Harmful microbes are destroyed by intense UV-C LED light. Focused on the 270-280nm ultraviolet wavelength, the UV-C beams penetrate and disrupt the DNA and RNA of viruses and bacteria. Tested in an independent laboratory, the GP5611's UV-C light beam eliminated over 99.9 per cent of viruses in 10 minutes, and 99.9 per cent of bacteria in just 49 seconds.

The unit is sized and shaped to fit in a car's cup holder. Its filter cartridge—said to last about a year—effectively removes formaldehyde, toluene, VOCs, bad smells, and engine exhaust gases from the air. Its HESA (High Efficiency Selective Absorption) technology even works when the device is switched off, so it removes chemicals and odors even when the car is parked and unoccupied.

In addition to the UV-C light, it has SaniFilter Plus technology, fitted with an antimicrobial layer, which captures 99 per cent of ultra-fine particles floating in the air inside a car, including viruses and bacteria and others as small as 0.004 µm, 1/40 the size of the coronavirus and 1/100 the size of bacteria.

The Design Lounge

2022 Pininfarina Teorema Concept (VR study)

THE DESIGN LOUNGE

Amidst the current surge of BEVs (battery electric vehicles) Pininfarina's new concept—introduced only in virtual reality—showcases the creative potential in using a new BEV platform. Pininfarina worked closely with suppliers to create a new interpretation of fully electric, autonomous mobility centered around user experience and technology, designed to create a sense of community and foster interactions amongst passengers and the outdoor environment, based on three modes of usage.

In *Autonomy Mode*, the driver faces the other four passengers, leaving enough distance between each other to give everyone the feeling of having their own private cocoon. In *Drive Mode*, there is a community feeling and everything that happens in the motion of the vehicle is shared. The different areas of the interiors take on the same color, providing a subconscious connection holding all the occupants to a shared experience. And in *Rest Mode*, the whole interior becomes a social space where people can move to any position they want. The internal environment and the smart seats automatically changes to allow people to socialize or lounge around.

Very interesting is the format and packaging of this vehicle that evinces a mid-engine concept of the 1960s and '70s, when the Italian mid-engine supercar was being explored and defined as a concept and package; Italdesign's 1968 Bizzarrini Manta was a three passenger contraption, 4.1 meters long and 1 meter high, with the driver center-seated:

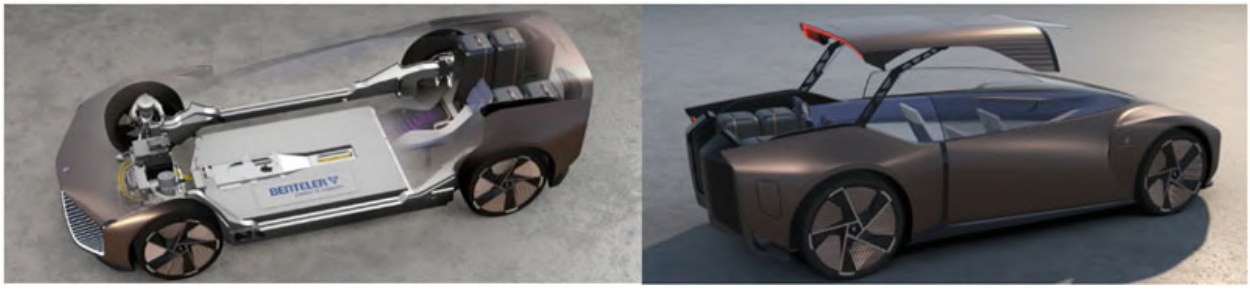
Pininfarina's use of a dedicated BEV platform shows how eliminating the large V8 engine for this type of low-slung vehicle can allow a more versatile interior environment.

2021 MERCEDES EQS: 5.2 METERS LONG; 1.5 METERS HIGH

2021 LUCID AIR: 5 METERS LONG; 1.4 METERS HIGH

2021 PININFARINA TEOREMA VR CONCEPT: 5.4 METERS LONG; 1.4 METERS HIGH

When we compare the latest premium BEV packages form Mercedes and Lucid, we can see that the Teorema has been kitted out with cutting-edge technologies from supplier partners to provide a five-passenger, 1·2·2 seating arrangement. Let's take a closer look at some of those suppliers and their contributions:

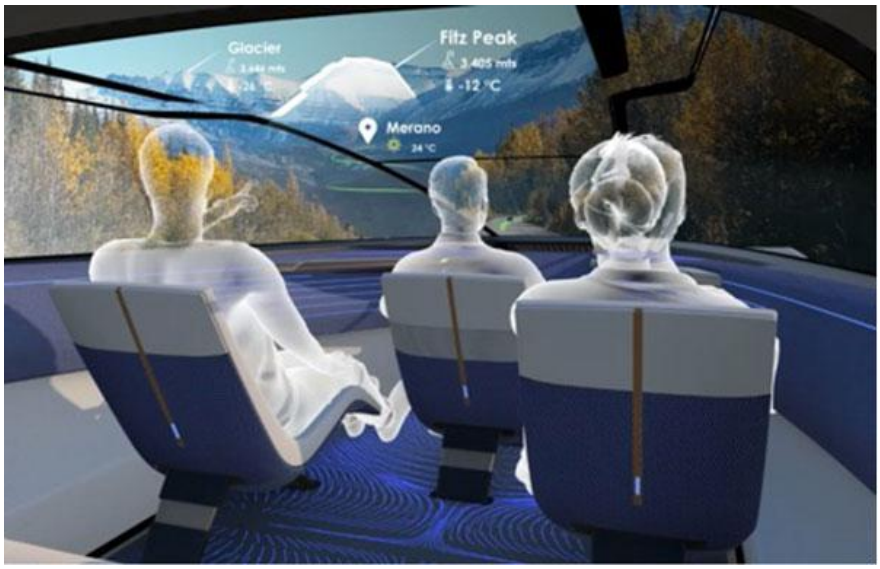


(IMAGES: PININFARINA)

Benteler: the rolling chassis

A platform built on the Benteler Electric Drive System (BEDS) is a very efficient solution and an enabler for setting up new electric vehicles very fast, with reduced complexity and high quality, thanks to its scalable and modular design. This allows the car to have a spacious interior despite the low height.

As described by Pininfarina, the use of the Benteler chassis allows for a re-think of conventional entry and exit from the vehicle. By entering—we almost want to say "boarding"!—from the rear/luggage compartment, the overall environment of the interior space is drastically reworked allowing for a spacious central cockpit for the driver and passengers.



(IMAGE: PININFARINA)

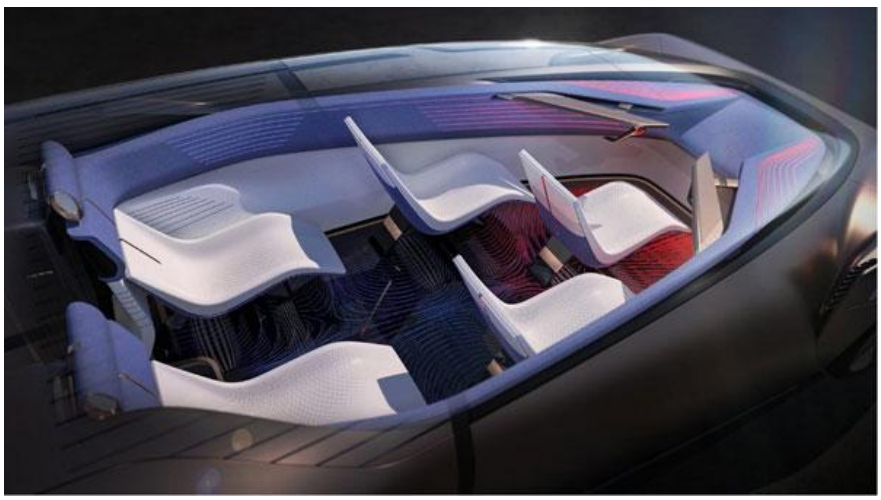
Continental Engineering Services: smart surfaces and intelligent glass

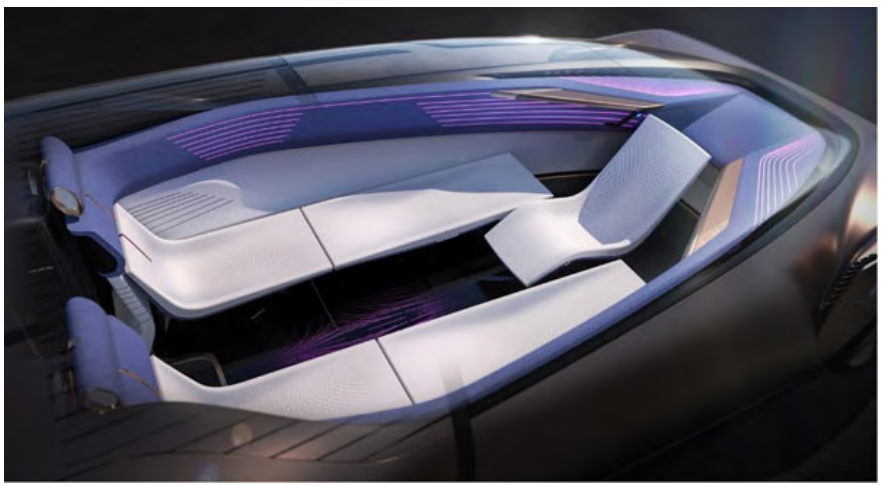
Continental's expertise in smart surfaces and intelligent glass provide the car with important user-experience and safety features. Pop-up buttons are hidden under the car's interior surfaces and only emerge when the driver passes their hand over them. Each button has a slightly different shape, allowing the driver to easily recognize them without taking their eyes off the road. Smart glass in the rear of the car allows passengers to enjoy their privacy and to regulate the light that enters from the outside, giving then the possibility, also thanks to the foldable flat seats, to create a comfortable cocoon in which to rest.

WayRay: True augmented reality

Crisp and vivid virtual images with unprecedented color depth are aligned with the real world and allow passengers to be informed about the relevant traffic information, the places of interest, and curiosities. They appear behind the car's windshield and side windows. Passengers may also interact with the information displayed in order to learn more or share it with other people onboard.

With the Teorema concept, Pininfarina and their supplier ecosystem have chosen to completely eliminate the digital screens that are prominently used in interiors today, thus creating a very open and calming interior.

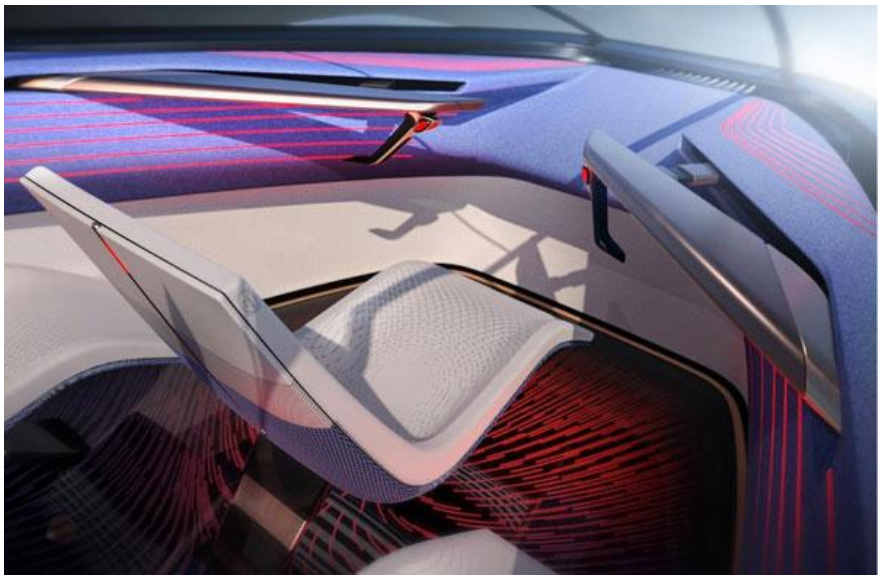




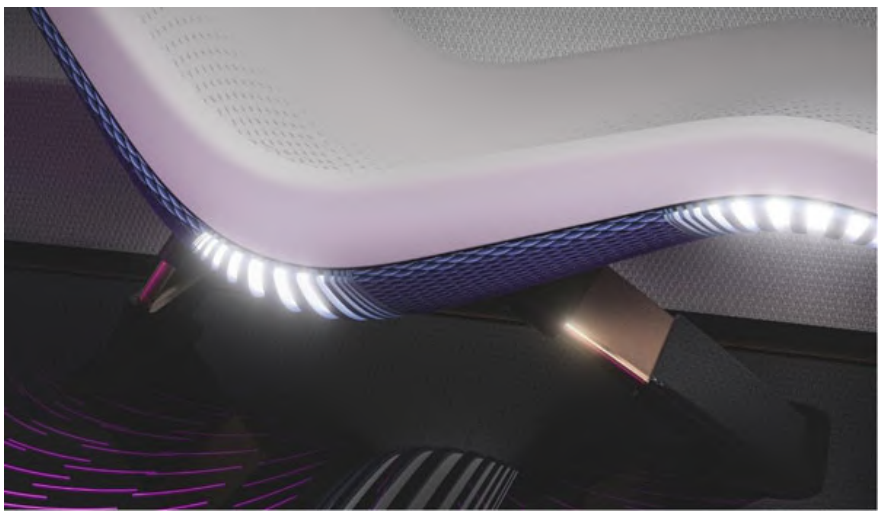
(IMAGES: PININFARINA)

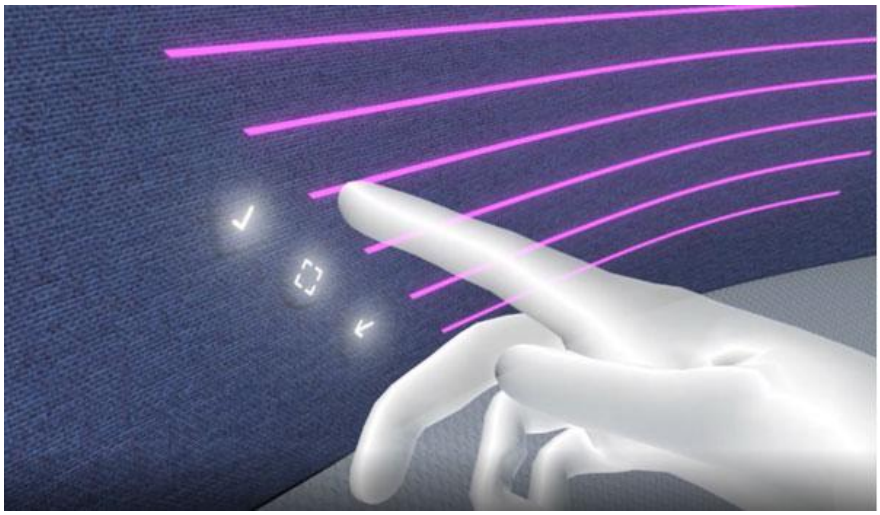
Poltrona Frau: Seats

The seats were designed together with Poltrona Frau to ensure maximum relaxation and allow passengers to stretch out and doze off. The seats can fold down flat, turning into a bench or a cot providing for the possibility either to face each other, in a moment of conviviality, or to lie down, during a more intimate time.



The occupant and driver`s areas are convertible so that spaces both social and driver-focused are created. The use of joysticks instead of the traditional steering wheel adds to the sci-fi concept effect, although safety retraints such as seatbelts and headrests are a curious omission.





Lighting elements on the seats, floor and door-panels totally supplant traditional switches and automotive interaction.

After 2020's loss of auto shows and the associated concept car debuts, it is refreshing to see Pininfarina—a pedigreed design firm with a strong legacy—push the envelope of what a BEV can become.

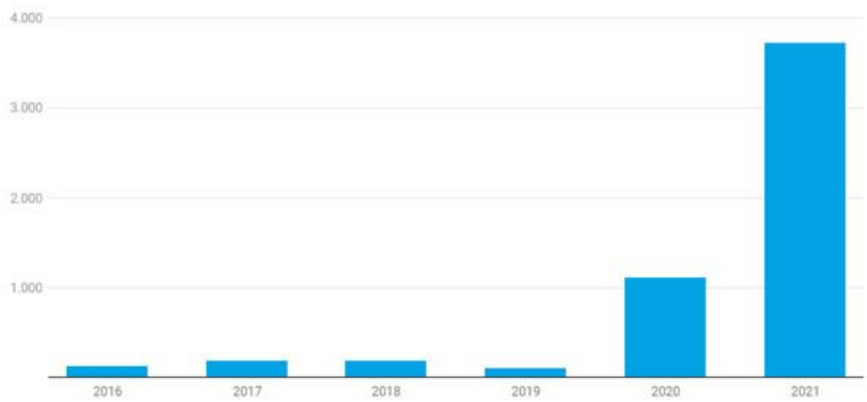
News Mobility

Will Air Taxis really happen?

NEWS MOBILITY

The answer looks like *yes*. In a few years, air taxis are set to really take off. Companies like Volocopter and Lilium are working feverishly on it. Recently, more and more money has flowed into the sector; according to estimates, it is now around USD $5.5bn. Joby has raised the largest sum so far, an estimated $1.6bn. The № 2 spot goes to Lilium, with $1.2bn, then Archer ($1.1bn) and Volocopter ($335m).

This graph shows investments in air taxi companies in millions US Dollars; 81 per cent of the money is invested in the six largest firms: Joby, Lilium, Archer, Volocopter, Ehang and Kittyhawk.



PORSCHE CONSULTING

The management consultancy Porsche Consulting expects that the first commercial air taxi services could be launched around 2025. In a study to this effect, the authors attest that vertical flying machines "definitely have the potential to develop into an attractive means of transport in the next 15 years". The air taxi market will probably be worth around $32bn by 2035. However, there are still considerable risks along the way.

Porsche Consulting assumes that the interested companies will have to invest at least $20bn in advance. Five to ten billion of this will flow into development alone. Study author Gregor Grandl comments: "For air taxis to become a reality for everyone, you need courageous pioneers with a sense of responsibility, staying power and deep pockets." Not everyone has that: Uber, for example— a company known more for shaking up ground-based rides-for-hire and for recategorizing employees as hapless contractors than for making a profit—sold off their air-taxi operations last year.
Investments seem daring above all because it is still unclear whether the necessary legal framework and a corresponding infrastructure will be created in the coming years. According to the study authors, at least half a million passengers per day would have to use an air taxi in 2035 for the sector to become relevant. This in turn would require between 1,000 and 2,500 take-off and landing sites in up to 60 cities. The use of air taxis is already firmly planned in the likes of Dallas, Dubai, Guangzhou, Los Angeles, Melbourne, and Singapore. Porsche Consulting counts Berlin, Frankfurt, Hamburg and Munich among the potential German markets.

Porsche Consulting is certain that air taxis have a chance if they are comfortable, safe, reliable, and attractively priced. By attractively priced, the authors mean that a flight should be about as expensive as a comparable taxi ride. However, Porsche Consulting does not expect air taxis to gain much traction in the foreseeable future; they estimate the share of air taxis in the global mobility market in 2035 at 0.3 per cent. The authors conclude from this that air taxis will hardly solve the current and future traffic problems. Or as Federico Magno puts it: "The mobility of the future needs more ideas and concepts".

Ford's Lincoln-Specific BlueCruise Variant

NEWS MOBILITY

(IMAGE: FORD)

Ford announced earlier this year their hand-free highway driving system, destined to join the maker's suite of advanced driver assistance systems. It is called BlueCruise, and DVN Interior covered it on July 8. Now Ford's luxury brand Lincoln—in parallel with a teaser of their first EV—announced their version of BlueCruise, called ActiveGlide.

Both driver-assistance technologies use a combination of camera and radar systems to enable hands-free steering assist on prequalified sections of divided highways called Hands-Free Blue Zones. While active, the system will automatically steer to keep the vehicle between the painted lane lines and automatically brake and accelerate to maintain a preset distance behind a leading car. Ford says they will have pre-mapped more than 160,000 km of Blue Zones in the United States and Canada when the technology launches.

It’s an L^2 system, like Tesla's imaginatively-named "Full Self Driving", which means it isn't yet an autonomous technology; it still requires the driver's attention. Like and General Motors' Super Cruise, it’s really a DMS, watching the driver's face to make sure they're awake, alert, and watching the road.

ActiveGlide most likely it could be expected to co-launch with Lincoln's first EV, the Mark E SUV, which is to be built through a partnership with electric-vehicle upstart Rivian for 2022.

General News

Volkswagen remains Technology Leader: Study

GENERAL NEWS

THE HEAD-UP DISPLAY OF THE VW ID.3 IS ONE OF VW`S INTERESTING INNOVATIONS (IMAGE: VW)

The Volkswagen Group was once again the most innovative car manufacturer in the world in 2020. According to a study by the Center of Automotive Management (CAM) in Bergisch Gladbach, VW earned the Automotive Innovations Award by staying ahead of Daimler and Tesla.

For the ranking, industry experts headed by Stefan Bratzel evaluated, among other things, the number of technical innovations and world firsts, taking into account the degree of maturity and customer benefits of the inventions. CAM worked with management consultants PWC to analyze the innovations of around 80 automotive brands from global car manufacturers and startups. 645 individual innovations were evaluated.

Volkswagen scored points for the high electric range of their compact plug-in hybrids and for developments in automated driving, among other things. The lane and orientation light of the Audi E-Tron and the VR head-up display of the VW ID.3 also scored well.

In addition to the three overall winners, Ford and BYD also received good ratings, qualifying for second and third place among the volume brands behind VW. The Chinese company was particularly convincing with their battery innovations.

Among the premium brands, Mercedes finished ahead of BMW and Tesla. The most innovative model in 2020 was the Mercedes S-Class with its interior and connectivity innovations, followed by the Tesla Model Y and Ford Mustang Mach-E. Six suppliers are also among the award winners, including the cooperation between Bosch and Weichai to develop efficient diesel engines and the Chinese battery cell manufacturer CATL. The latter two have recently made considerable gains, moving up several places in the ranking of the world's 100 largest suppliers.

Chip Shortage and Supply Crisis

GENERAL NEWS

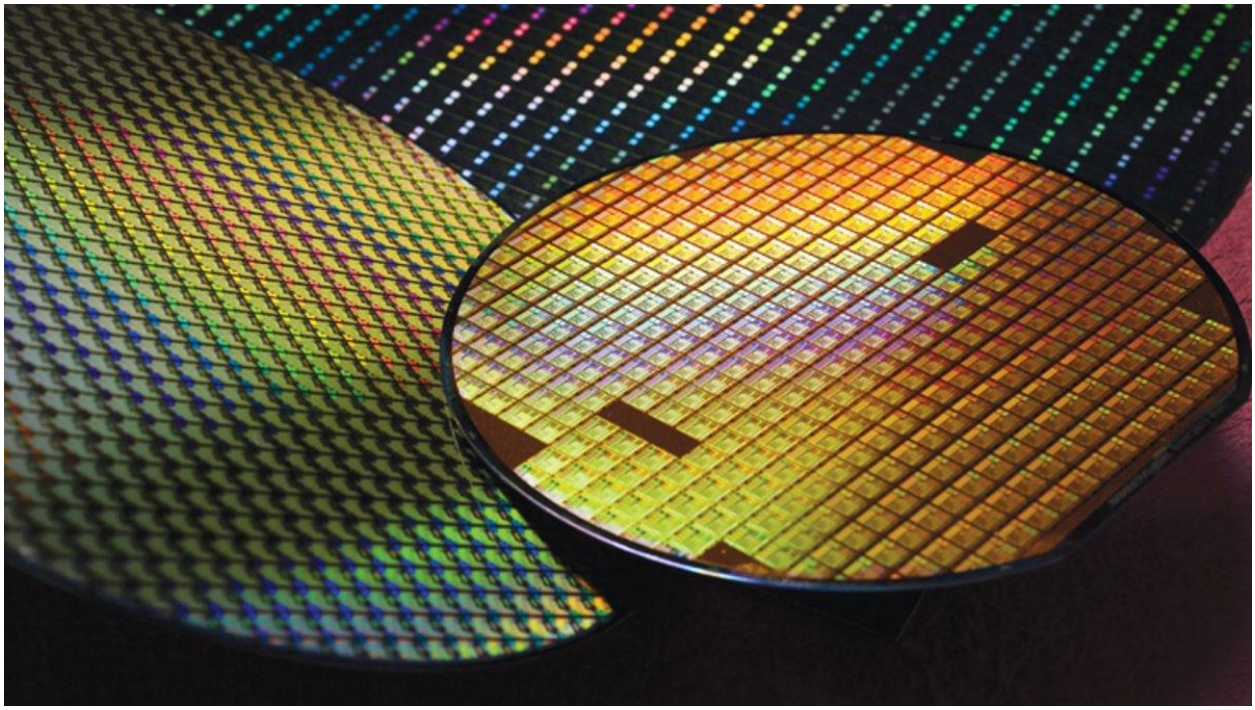


IMAGE: TAIWAN SEMICONDUCTOR MANUFACTURING

For more than half a year, the chip shortage has been hampering the global car industry. Suppliers had pivoted to IT or consumer electronics after carmakers virtually cancelled their orders for large quantities of semiconductors due to the pandemic, and now car production is ready for full throttle again, production capacity is scarce for microtechnology.

Electronic components have their sandy little feet in just about everything we touch these days. Their function is based on the properties of elemental silicon and germanium. Unlike strong conductors, these semiconductors allow the precise control of weak current flows —a basic principle for integrated circuits, which is what we mean when we say "chip" in this context. Even the processing and construction of simple modules are complex, and not many companies can do it.

After the general triumph of the computer and smartphone, applications in the car are considered the future business of semiconductor producers. Even before the rise of e-mobility and networking, engine control units, on-board computers and assistance functions were unthinkable without electronics. The same applies to memory and sensors, which, according to semiconductor expert Ulrich Schäfer, "will have significantly above-average growth". Weber adds: "Autonomous driving and infotainment in cars will increase the demand for special chips even more. This also applies to sensor technology"—for example in the traffic infrastructure with signal transmitters on roads or buildings. Semiconductor components such as diodes are also found in the increasingly used LED lighting, both inside and outside.

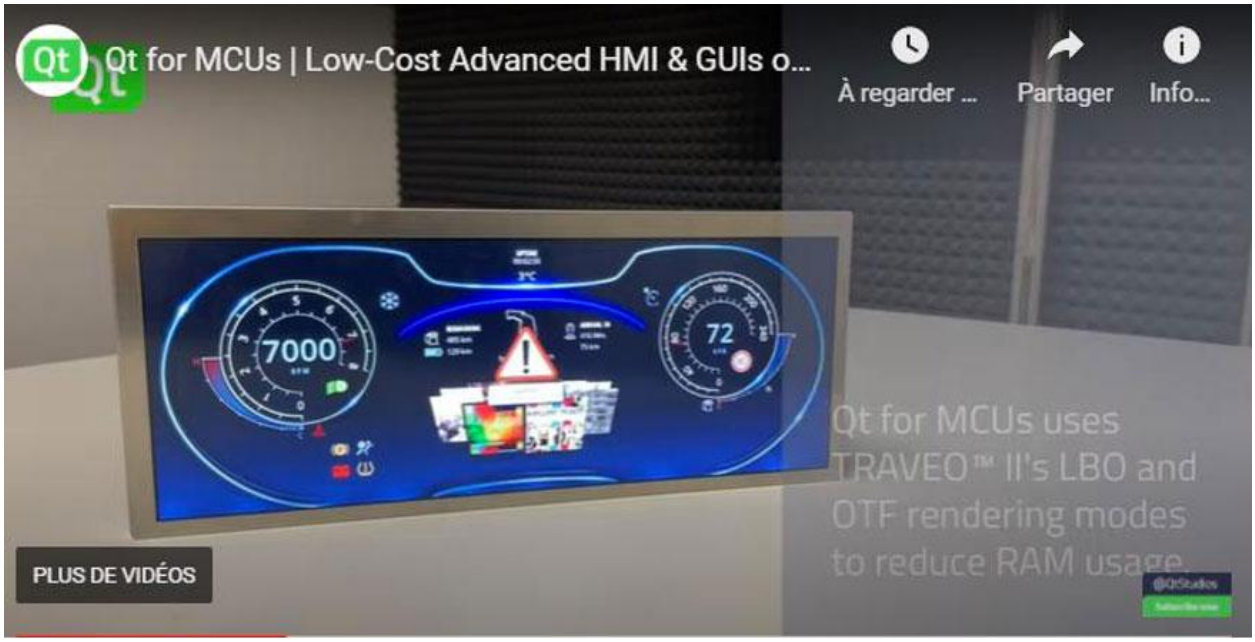
Industry association VDA warns: "The supply of semiconductors will remain tight in the second half of the year. Intensive work is being done globally to secure supplies—especially at the chip manufacturer level". The consulting firm Alix believes that up to 3.9 million fewer vehicles could be built worldwide in 2021. Audi restarted production in May after work stoppages for 10,000 workers. Porsche expects an improvement in the second half of the year. BMW had to cut production at their largest European plant in Dingolfing, and there was also short-time work in Regensburg. The board already saw more

fluctuations in the second half of the year in May; boss Oliver Zipse expects the crisis to drag on for one to two years.

Politicians like to appeal to German manufacturers like Infineon, Carl Zeiss SMT, and Siltronic/Wacker to invest more for an own production of semiconductors. But it is not unusual for billions of whatever currency to be needed for such factories. Bosch just opened a new plant in Dresden, the largest single investment in the company's history.

Qt, Infineon Partner on HMI Development Tools

GENERAL NEWS



Software developer Qt says their latest partnership with Infineon, which leverages the latter's HMI Tool Certification Program, will help users reduce costs when delivering high-performance instrument clusters and body controls that use Qt for MCUs and the Traveo II graphic controllers.

Qt is a widget toolkit—**See video**—for creating graphical user interfaces as well as cross-platform applications. Qt is currently being developed by The Qt Company, a publicly listed firm, and the Qt Project under open-source governance, involving individual developers and organizations working to advance Qt.

Infineon Technologies is a German semiconductor manufacturer founded in 1999, when semiconductor operations were spun off from the former parent company Siemens. Infineon has about 47,000 employees and is one of the ten largest semiconductor manufacturers worldwide.

Cypress Semiconductor was bought in 2019 by Infineon, with specialy in offered NOR flash memories, F-RAM and SRAM Traveo microcontrollers.

Qt states that the collaboration with Cypress creates a perfect solution for development of richer HMI solutions on the Traveo series, while providing support across the gamut of needs from low-power to high-performance applications.

The partnership, they say, enables engineers to easily create next-generation UIs and UXs for embedded devices and scalable digital experiences for cars and helps companies expand the embedded portfolio to accelerate the next scalable HMI applications.