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Next Generation – Audi at the International CES

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The equipment and data specified in this document refer to the model range offered in Germany. Subject to change without notice; errors and omissions excepted.

Summary

“Next Generation” – Audi at the 2014 International CES

“Next Generation” is the motto under which Audi is appearing with a virtual fireworks display of innovations at the Consumer Electronics Show (CES) taking place in Las Vegas from January 6 - 10, 2014. Audi is showing its future solutions for the megatrends piloted driving, infotainment, connectivity, operation and display, and its groundbreaking lighting technologies at the world’s most important consumer electronics trade show.

“In electronics, the innovation cycles are extremely short and the competition is particularly intense,” says Prof. Dr. Ulrich Hackenberg, Member of the Board of Management of AUDI AG, Technical Development. “We therefore feel obligated to become even more progressive, agile and innovative. We were first-to-market in past years with many technologies, and we will maintain and further extend this advantage.”

Audi already offers a wide range of assistance systems that make driving even more composed. They are available in many models, including in the compact A3 family. For the company’s next big step, Audi will introduce its new technologies for piloted driving before the end of this decade. Audi is doing pioneering work in this field. In 2013, Audi became the world’s first carmaker to receive a license from the Nevada Department of Motor Vehicles to test autonomous vehicles. As part of the licensing process, Audi demonstrated piloted driving in traffic and when parking. The systems were in the predevelopment phase, and the computer technology filled the entire trunk. The concept for implementation in production vehicles has been verified and is now in production development. The central driver assistance control unit (zFAS) for piloted driving announced at the 2013 CES was developed in just one year. The message for piloted driving at the 2014 CES: Audi is extending its lead and is already driving with production technology.

Another highlight being shown by Audi is the next generation of the Audi MMI system. Familiar elements such as the rotary/push button control and MMI touch are still there in the new generation, but they are now even better and more intuitive than ever. There is one noticeable difference with the MMI user terminal: The number of function buttons has been reduced from four to two. The surface of the MMI touch now also understands multitouch gestures from the world of smartphones, such as zoom and scroll. A particular highlight is universal MMI search. When using the navigation function, this direct search allows the driver to just begin writing without having to use a rigid form. In most cases, the desired results show up on the display after entering just a few letters.

Audi was the first carmaker to offer a fully integrated UMTS interface in all its models. Audi is now also the first carmaker to fully integrate LTE into the automobile. This high-speed data technology will be rolled out successively to all Audi models, beginning with the launch of the new Audi A3. The long-standing partnership with Qualcomm makes this possible. The full integration of Qualcomm's LTE technology will enable the range of Audi connect services to be extended in intriguing ways: music services in the cloud, fast online updates, high-speed video conferences, car-to-x communication and much more.

Among the new car-to-x applications at Audi is the service Online traffic light information. It networks the car with the central traffic control computer that controls the traffic lights in the city. Targeted information appears in the display of the driver information system. It shows the driver the speed to select in order to reach the next traffic light during a green phase. The time remaining is displayed while waiting for the light to turn green. The system's technology is fully mature; Audi can deploy it in all of its models. Audi is in active discussions with the operators of the traffic infrastructure.

Audi introduced another first in 2012: the Audi phone box. This very useful feature has now been updated with wireless charging. The electricity in the floor of the phone box flows to a receiver coil in the smartphone via induction according to the Qi standard. In the future, the Audi phone box will thus not only provide for perfect reception, but also ensure that the smartphone is fully charged at all times. Audi uses the WLAN hotspot in the car to intelligently combine the world of smartphones and tablets with the automotive world.

Now Audi is opening a new chapter. As the standard-bearer for the entire Volkswagen Group and a founding member of the Open Automotive Alliance, the company, in partnership with Google, will be the first carmaker worldwide to seamlessly integrate Android devices into its vehicles.

The modular infotainment platform (MIB) with the Nvidia Tegra 20 processor was first announced at the 2012 CES. The Audi A3 with the MIB and Tegra 20 was on the road just one year later. Audi is announcing a further highlight at the 2014 CES: The updated MIB with the Nvidia Tegra 30 processor will go into series production with the new Audi TT. The interior of the new Audi TT is also making its world premiere. The highlight here is the new Audi virtual cockpit.

The computing and graphics power of the Nvidia Tegra 30 enables a whole new generation of instrument cluster with unprecedented performance and precision. The graphics and dial instruments are rendered naturally and tack-sharp on the brilliant 12.3-inch display. Transparency effects and animations combined with the high-end resolution creates a whole new experience for the driver.

In another first for carmakers, Audi is presenting a new dimension of in-car entertainment: the Audi Smart Display. This represents the perfect combination of the latest technology from the consumer sphere with the robustness and reliability of the automotive sphere in a tablet suitable for use in the car. It has a 10.2-inch, full-HD display and a brushed aluminum case. A WLAN interface connects it to the car. The heart of the Smart Display is the state-of-the-art computing and graphics power of the Nvidia Tegra 40. The Audi Smart Display connects the car to the consumer world and vice-versa. Passengers in the front or rear seats can use the touchscreen to control the car's radio, media, navigation and other convenience functions.

The Smart Display uses the Audi sound system for perfect sound reproduction. In addition, the Audi Smart Display uses the Android operating system to access the Internet at LTE speeds via Audi connect. The customer thus has access to more than 950,000 apps plus movies, music, audio books and eBooks via Google Play, the Android app store.

The close collaboration with the big players of the consumer sphere and Audi's expertise in quickly bringing these technologies to the car takes the networking of the car with the Internet to a whole new dimension.

Audi has long been the benchmark when it comes to lighting technology. The latest innovations are the Matrix LED headlights and dynamic turn signals in the new Audi A8 luxury sedan. With Audi Matrix LED headlights, the high beams can be used all the time without blinding other road users. Another worldwide first being presented at the 2014 CES are the first laser headlights in an automobile. They are premiering in the Audi Sport quattro laserlight concept, and will also debut later this year at the 24 Hours of Le Mans in the new Audi R18 e-tron quattro. These laser headlights emit a monochromatic and coherent light with a wavelength of 450 nanometers. They have a range of 500 meters (1,640.42 ft), roughly twice as far as an LED high beam.

Broad-based expertise in the field of electronics allows Audi to break new ground when it comes to collaboration with its suppliers. In the Progressive Semi Conductor Program (PSCP), multiple semiconductor manufacturers have the status of strategic partners and are thus tightly integrated into the development process. Another investment in the future is the Audi Urban Future Initiative. The interdisciplinary think tank, in which top-rank experts ponder mobility in the megacities of the future, is presenting its latest projects at the 2014 CES.

Rounding out Audi's appearance in Las Vegas are three spectacular cars: the dynamic new Audi S8, the elegant and networked Audi A3 Cabriolet and the Audi Sport quattro laserlight concept, a technology study. The coupe, which is making its debut at the CES, has all of the latest Audi innovations on board: laser high beams, Audi virtual cockpit, next-generation MMI, LTE hotspot, the integration of Android devices and the Audi Smart Display.

Driver assistance systems and piloted driving

Audi is a driving force in the area of driver assistance systems. The next step will be systems that assume the task of driving in certain situations if the driver so desires. Audi refers to this as “piloted driving.”

Driver assistance systems of today

From adaptive cruise control with stop & go function to traffic sign recognition, Audi offers an extremely wide range of driver assistance systems across the entire model lineup. The systems are tightly networked, making them intelligent, powerful and versatile.

adaptive cruise control with stop & go function

The core component of the Audi driver assistance systems is adaptive cruise control (ACC) with stop & go function. The system regulates the vehicle’s speed and distance to the vehicle ahead, in many models over a speed range from 0 to 250 km/h (*0 to 155.34 mph*).

Depending on the configuration, ACC stop & go uses one or two radar sensors at the front of the vehicle. They detect the reflections of objects as far as 250 meters (*820.21 ft*) away from the car. The driver can adjust the distance to the car ahead and the control dynamics in multiple levels. In stop-and-go traffic, the system can brake the car to a complete stop. After a brief stop, such as at a traffic light, it automatically drives off and follows the vehicle ahead; after a longer stop, the driver must tap the accelerator pedal or briefly activate the control stalk to resume driving.

Adaptive cruise control with stop & go function interacts closely with other driver assistance systems; it utilizes the data of numerous control units to continuously analyze all of the car’s surroundings. The system uses this broad knowledge base to recognize complex scenarios and offer anticipatory support to the driver. Because it also works together with the optional MMI navigation plus, it knows the course of the selected route and can use this information to regulate the car's speed.

Audi offers a number of versions of adaptive cruise control for different model series – including without the stop & go function.

Audi active lane assist

Audi active lane assist is available for most models with electromechanical power steering. It uses a camera with an angle of aperture of roughly 40 degrees mounted in front of the rearview mirror to detect lane markings at a range of more than 50 meters (*164.04 ft*). The camera and software recognize the lane markings and the path of the car. If the car approaches a line without the turn signal being activated, the system helps the driver to steer back into the lane by intervening discretely in the steering.

The driver determines via the MMI system how soon the intervention occurs and whether it should be combined with steering wheel vibration. If the driver opts for early intervention, the system will keep the car in the center of the lane. The camera of the Audi active lane assist provides differentiated information. For example, it can differentiate between the yellow lines in construction zones and white lines.

Audi active lane assist becomes active at a speed of approximately 65 km/h (*40.39 mph*). It also intervenes if there is a risk of skidding. In this case, it supports correct countersteering by briefly increasing or reducing power steering boost.

Audi side assist

The lane change assistant Audi side assist is available for many Audi models. It monitors traffic behind the car and warns the driver of critical lane changes as necessary. The system begins to operate at a speed of about 30 km/h (*18.64 mph*). Two radar sensors in the rear monitor events behind the car at a distance of up to 70 meters (*229.66 ft*).

If there is a vehicle in the blind spot or rapidly approaching from the rear, a yellow LED indicator in the outside mirror's housing lights up. The driver sees the LED when checking the mirror. If the driver nevertheless activates the turn signal to change lanes, the indicator become brighter and flashes multiple times.

The optical signals are aimed at the driver. Their brightness varies according to the ambient light level and can be set individually using the MMI system.

Night vision assistant

The heart of the night vision assistant is a thermal imaging camera with a 24-degree angle of aperture at the front of the automobile. It works in the far infrared range (FIR) and reacts to the heat radiated by objects in the recorded scene. A computer converts the information from the camera into black and white images and shows them on the driver information system's central display, if desired.

Far infrared technology can look up to 300 meters (*984.25 ft*) ahead, far beyond the range of the high beams. It is not affected by glare from headlights or similar light sources. Because of the heat they give off, people and larger wild animals generally appear strikingly bright against the cooler and thus darker background, making them easy to recognize. Within system limits, the image processing software can detect persons at distances up to 90 meters (*295.28 ft*) and larger wild animals at up to 130 meters (*426.51 ft*). It looks specifically for characteristics of pedestrians and larger wild animals, such as their contour. It highlights detected persons and animals in yellow on the display.

If the system predicts a hazard because a person is crossing the road in front of the car, for example, the person is marked in red and a warning tone sounds. The driver can also choose to have a warning displayed in the optional head-up display. The brake system is conditioned at the same time. In some models, the pedestrian will be illuminated with three brief flashes of light.

Park assist

The Audi parking systems work with ultrasound. One particularly convenient solution is park assist. It completely takes over the steering when backing into detected parking spaces either parallel or perpendicular to the road. The system finds parking spaces using ultrasound sensors that scan the side of the road in two dimensions while driving at moderate speed. When they detect a space of sufficient size, a message appears in the instrument cluster.

If the driver wishes to park in the space, they put the car in reverse with the system active and the park assist system takes over the steering. The driver only has to accelerate, shift gears and brake. The park assist will maneuver forward and back multiple times and also helps when leaving parallel parking spots.

Another technology from Audi is the parking system plus with surround view cameras. Four small cameras – in the Singleframe grille, in the rear and in the housings of the side mirrors – record the car's immediate surroundings. The driver can call up a variety of perspectives on the large onboard monitor, including a virtual top-down view. At corners or junctions with limited visibility, the system can show cross-traffic in front of or behind the vehicle that the driver cannot see directly.

Camera-based traffic sign recognition

The camera-based traffic sign recognition system shows the driver the detected speed limit in the instrument cluster or the optional head-up display. A camera behind the rearview mirror detects both speed limit signs on the side of the road and digital speed limit indicators. The control unit compares them against the data from the navigation systems, the maximum permissible speeds in the respective country and information from the vehicle, such as whether the wipers are on and the current time.

Audi pre sense

Audi pre sense is a safety package available in a variety of configurations in numerous model series in addition to the A3 family. Audi pre sense basic analyzes the information provided by the sensors of the electronic stability control (ESC) system. Depending on the situation, the system activates the hazard warning lights and begins to close the windows and the optional sunroof if the sensors report maximum braking or skidding. It also tensions the front seat belts. Small electric motors trigger this tensioning, which is reversible.

The extended versions of this safety system are Audi pre sense front, Audi pre sense rear and Audi pre sense plus. They work closely together with the Audi adaptive cruise control with stop & go function and Audi side assist driver assistance systems.

Audi pre sense front monitors traffic in front of the car for potential collision hazards. The system provides multiple stages of driver support. The first comprises an optical and acoustic warning signal; the second a warning jolt – a brief application of the brakes. If the driver then brakes, the system helps by adjusting the amount of brake pressure required. If the driver does not react, the system initiates partial braking as the third stage. This slows the vehicle with about one-third of the possible braking power. The windows and optional sunroof begin to close, the hazard warning lights are activated and the seat belts are tensioned.

If the car is equipped with the full version of Audi pre sense plus, a fourth stage comes into play: first another round of partial braking at a moderate level, followed by maximum braking, during which the seat belts are fully pretensioned. This occurs shortly before impact, when a collision can no longer be avoided. Audi pre sense plus reduces the vehicle's speed by up to 40 km/h (*24.85 mph*) before impact, which mitigates the consequences of the accident.

In some models, Audi pre sense front offers an additional protective function to mitigate or prevent collisions with the car ahead at low speeds. Below 30 km/h (*18.64 mph*), the car brakes autonomously in a critical situation, regardless of whether the vehicle ahead is moving or stopped. Below 20 km/h (*12.43 mph*) the new function can generally prevent the accident entirely. In other cases it significantly reduces collision speed and thus the severity of the accident.

Audi pre sense rear uses the Audi side assist sensors and mitigates the consequences of a rear-end collision. Here, too, the system closes the windows and sunroof and tensions the seat belts. If the car has optional front memory seats, they adjust to a position more favorable to passenger safety.

Piloted driving: taking the fun of driving to a whole new dimension

In the near future the driver assistance systems from Audi will be even smarter and more powerful, and many assistive functions will find their way into cars. Audi calls these functions “piloted driving.” The new systems will take over the driving in certain situations, making it more comfortable and safer. Nevertheless, it always remains the driver's choice to turn over the wheel.

Piloted driving in traffic jams

Piloted driving in traffic jams will take the stress out of driving in slow-moving traffic in the future. At speeds between zero and 60 km/h (*37.28 mph*), the system takes over the steering. It also accelerates and brakes autonomously. The Audi system for piloted driving in traffic jams continuously assesses the status of the car and its entire surroundings. If the system detects a traffic jam situation (with physical separation of the opposing lane or lanes) at speeds below 60 km/h (*37.28 mph*), the driver can activate the function. The car then assumes full control. It behaves exactly like Audi ACC stop & go in accelerating and braking; it also reacts cooperatively to cars moving into or out of the lane.

When piloted driving reaches its system limits are reached, such as when the traffic jam dissolves or the end of a divided road is reached, it prompts the driver to take back control.

If the driver does not take back control within a few seconds of being prompted, light braking and a more intensive warning are triggered. If the driver fails to react within an additional five seconds, the system establishes a minimal-risk state. The car is braked to a stop and the hazard warning lights are activated.

As with Audi adaptive cruise control with stop & go function, a radar system monitors the area in front of the car in a 35-degree field of view and at a distance of up to 250 meters (*820.21 ft*). A video camera with a wide angle of aperture detects the lane markings as well as pedestrians and objects, such as other vehicles and guard rails. Up to twelve ultrasonic sensors are used to monitor the space near the car.

And now a laser scanner is being used for the first time. It provides highly precise data at a range of up to 80 meters (262.47 ft) Its laser diode emits nearly 100,000 infrared light pulses per second that are invisible to the human eye. The sensor scans a field of view of 140 degrees with a resolution of 0.25 degrees over four different levels. The control unit computes a highly detailed surroundings profile from the light reflections. This profile represents other vehicles as well as guard rails. The key advantages of the laser scanner are:

- a) Because of the large angle of aperture, cars entering the lane are detected very early.
- b) The laser diode means that it is fully functional in the dark.
- c) Its measurement method enables it to detect any objects, even those with a solid pattern or with no visible structure.

Piloted driving for parking at curbside and in garages

Parking in tight quarters is uncomfortable. Narrow parking spaces or garages make it difficult for the driver to get in and out of the car. Thanks to piloted driving from Audi, drivers will be able to operate the car comfortably via the remote key fob or smartphone while standing outside it in front of the garage or a narrow parking space.

The piloted parking function is offered to the driver when the environmental sensors detect a suitable parking space or garage. The driver can now get out and initiate the parking sequence. Upon reaching its parked position, the car shuts off the engine and locks the doors. The driver receives a confirmation message at the end of the process. The push of a button is likewise all that is required to retrieve the car from the garage or parking space.

The so-called “drive switch” (remote key fob or button on the smartphone) plays a key role. The customer must press and hold it continuously for piloted parking to begin. The system also verifies that the remote key fob is in the vicinity of the car (approx. 5 meters [16.40 ft], because the driver would otherwise not be able to monitor the parking process. The car of course stops if the sensors detect an obstacle in the driving corridor. The car can always be brought into a safe state. Piloted parking utilizes the same system of sensors as the traffic jam system. Information is also obtained by processing images from the four 360-degree cameras that monitor the surroundings. This additional physical measurement method complements the ultrasonic sensor system.

Driver assistance systems with maximum integration: the central driver assistance control unit (zFAS).

Today's driver assistance systems are mostly implemented in spatially separate control units. Audi will pursue the revolutionary approach of a central driver assistance domain architecture in the future. All available sensor information will then be compiled in a central control unit (zFAS), enabling the creation of a complete environmental model for the first time ever. This model is used by the classic driver assistance systems. Audi's piloted driving system, in particular, draws on this redundantly computed environmental information.

The zFAS board exhibits certain design parallels with the latest generation modular infotainment platform. Audi's strategic development partners also deliver advanced multi-core processors for the zFAS. All together, the processors on the zFAS board have the computing power of the entire electronics architecture of today's Audi A4. The new board currently has about the same area as a compact laptop computer, and its space requirements will continue to shrink rapidly. The modular concept ensures high scalability and future viability.

Audi has now implemented the research and predevelopment projects in a production-ready architecture, and will introduce it in production models in conjunction with piloted driving before the end of the decade. Audi has once again assumed the leading role. Specific properties of the Audi solution are:

- a) Unlike the usual predevelopment projects, this is not a PC implementation, but rather implementation in a production-ready zFAS control unit.
- b) The piloted parking and driving functions are combined in one control unit. Because these two customer functions will be merged in the medium term, separation in two control units is undesirable.
- c) The central fusion uses all available environmental sensors and thus satisfies the redundancy requirements for automated driving.
- d) Specific measures in the architecture and in individual components consider the requirements of functional safety and the relevant standards (ISO 26262).

Operation and Display

Audi places great value on the ergonomics of its automobiles – their control and display strategies are clearly structured and intuitive to understand. Now the premium manufacturer is firing the next rocket stage with the next generation Multi Media Interface (MMI) and the Audi virtual cockpit.

History of the Audi MMI

The first steps towards a MMI operating concept were made 17 years ago – its development began on paper in 1997. Even back then control was separated from display, and the control unit with the central rotary pushbutton was placed on the console of the center tunnel – a location that offered ideal positioning of the driver's hand.

Extensive customer surveys helped to refine the concept. An Audi S8 served as the test platform. In 2001, the brand presented the system to the public – the Avantissimo show car introduced the MMI with a TV tuner and Internet access.

In the following year, the system celebrated its market premiere in the new Audi A8 – with an electrically extending monitor and an entire bundle of control modules distributed throughout the car. Some units of the luxury sedan already had online telematic services on-board, and so they were far ahead of their time.

The new A8 model series of 2010 introduced another global innovation – MMI touch. Audi attained the top position among the global competition when it introduced a touchpad for inputting alphanumeric characters and symbols in many languages and a further optimized voice dialog system.

In the compact A3 model series, Audi is presenting the latest production level of its user control concept. It is based on the Modular Infotainment Platform (MIB), which processes all functions at high speed. Over the past 10 years, Audi developers boosted the computing power of the MMI by nearly a factor of 15 while reducing its weight by a factor of 10.

The driver controls functions either by voice control or from the MMI terminal. In the Audi A3, the MMI touch pad and the rotary pushbutton have been merged into a touchwheel: a touch-sensitive pad is implemented on the top surface of the control wheel. MMI touch detects the letters and numbers that the driver writes on the pad when inputting an address or a phone number; and the system provides acoustic feedback after each character is input.

Two rocker switches in the area in front of the terminal give users access to the most important areas of phone/navigation and media/radio; the switches are rounded out by a menu button and a back button. Four soft keys complete the user terminal; they are used to control subfunctions and volume control with an integrated Skip function for skipping tracks.

The LED display, which is only eleven millimeters (*0.43 in*) thick, outputs razor sharp 3D graphic images with a resolution of 800x480 pixels that are rich in contrast.

A special lamination process is used to mount its cover glass directly to the surface of the TFT screen. This improves its appearance and readability even in bright light. The painted housing is made of ultralight magnesium, which reduces its weight by around 50 grams. High-gloss and chrome accents lend it an elegant note.

MMI touch technology is not just exciting because it is easy to operate; it also makes a contribution towards safer driving. The interplay of handwriting recognition with acoustic feedback shortens operating actions, so that the driver can keep looking at the road.

New generation MMI operating concepts

Audi is continually developing the MMI interface. At the 2014 CES, the brand is presenting its new generation MMI. The primary benefits of the new generation are its simplified user operation and the universality of its possible applications. The premium carmaker is presenting three concepts at CES. The first is a classic version with an MMI terminal and an infotainment display in the middle of the instrument panel.

The Audi virtual cockpit, which will soon launch in the new Audi TT production model, is the second concept. It is a decidedly sporty version, in which the infotainment display and instrument cluster merge to form a flexible, driver-oriented unit. The brand is presenting the Audi Smart Display as a third concept. In a mobile version with touchscreen operation, the driver can remove the unit from the car and check out its simplicity outside of the vehicle – here the automotive world melds with the fast-moving world of consumer electronics.

New generation MMI

In introducing a new generation MMI, Audi is opening a new chapter in the history of HMI concepts – the MMI terminal and its menu structure were essentially redesigned from the ground up. This has resulted in simple, intuitive operation with flat hierarchies, which are fully oriented towards the needs of the driver.

The terminal of the new MMI still revolves around the familiar rotary pushbutton and MMI touch. Similar to the system already implemented in the A3, the touchpad and the rotary pushbutton merge to form a touchwheel with a touch-sensitive pad on its top surface. This pad is used to detect handwriting. New in this generation is high-resolution detection of wheel turning movements. The rotary pushbutton, whose rotary position is precisely monitored with hundredth of a millimeter precision by an optical sensor, offers users control of lists and maps that is nearly continuously variable.

The latest generation MMI touch also understands multi-finger gestures. For example, users can use two fingers to scroll through lists or zoom on the map, just as they are accustomed to doing on their smart phones. The two rocker switches for the most important menus – Navigation/map Phone, Radio and Media – have also been preserved. The primary difference is that the previous four buttons have been reduced to two function buttons, which significantly improves blind operation. The left button calls up the restructured submenu, and the right button accesses context-dependent options and settings, just like the right mouse button of a PC that is familiar to customers. In the new Audi TT, the main menu button and back button are located centrally beneath the touchwheel.

The new operating logic offers the same mode of operation that customers are familiar with in their smart phones and tablets. All frequently used functions are intelligently laid out for quick access.

The driver can access the main menus – such as Audi connect, Navigation, Map, Phone, Media, Radio, Sound, Vehicle and Options – by selecting them directly or from the start screen. A submenu is assigned to many of them for specific functionalities (left button) – e.g. the Radio menu has a submenu for radio band selection, and the Map menu has one for traffic information.

The button on the right is used to set additional options for a selected menu item; it is similar to the right mouse button that is familiar from PCs. In the Navigation menu, for example, the user might choose to be navigated to an input destination, to have parking spaces shown for the destination area or to save the destination as a favorite.

A special highlight of the new Audi MMI is MMI search. This is a practical function that assists the driver in searching for a term, simplifying the search. MMI search is available in every main menu. The results list is shown right away while the user is inputting – generally just a few characters suffice to come up with the term. In the Radio and Media menus, a character string leads directly to the desired radio station, track, album or performer.

In the Vehicle menu, synonyms may be used to find vehicle functions. For example, it is sufficient to enter just the word light to list all lighting functions such as Coming home and Leaving home and ambient lighting.

MMI search is especially helpful in navigation. When inputting a navigation destination, MMI search permits free text input without having to use a rigid formula. In most cases, just a few characters are sufficient to find any destination in Europe. It is no longer necessary to input the country. In the results display, the MMI takes the current location of the car into consideration, so that hits for the immediate vicinity are displayed first. When searching for a street near the car's position, it is generally only necessary to input the first few characters of the street name. When looking for a restaurant in any European city, all the user needs to do is input the first characters of the restaurant name and the first characters of the city name separated by a blank character; then the MMI lists relevant hits with addresses.

Most commands may also be given by voice input in the MMI. Voice control has also been further developed; the system now understands many phrases from everyday language usage.

Audi virtual cockpit

Another significant innovation that the brand with the four rings is presenting in the MMI area is the Audi virtual cockpit, a fully digital instrument cluster of the future. Its contemporary TFT display has a 12.3 inch diagonal. Its high resolution of 1,440 x 540 pixels makes all screen contents razor sharp, brilliant and rich in contrast. High-end animation and lighting effects round out its state-of-the-art look.

A fast graphics processor is at work in the background – Audi is the first carmaker in the world to use the Tegra 30 chip of the Tegra 3 series by Nvidia, a company with whom Audi has partnered for many years now. For the tachometer, the processor generates 60 frames per second in the Audi virtual cockpit, so that the needle shows the engine speed with absolute precision.

The driver can toggle between two user interfaces (modes) by pressing the “View” button on the multifunction steering wheel. In Infotainment mode, a central window dominates the view – it offers a big stage for the navigation map or for lists in the Phone, Radio and Audio areas. In this mode, the tachometer and speedometer, the latter with a digital display, appear as small round instruments on the left and right sides. In the Classic view, the middle window is smaller, and the instruments – with black scales, red needles and white numerals – are about as large as today’s instruments.

In the Audi virtual cockpit, the user can have any of the available information displayed – e.g. the navigation arrow, dynamic vehicle animations and images from the rear camera as well as graphics of the assistance systems. The display changes its context-related color scheme according to the main menu selected. In the Media menu, for example, the color is orange as usual, while the screen is tinted green for the Phone menu. Indicators with fixed positions are displayed along the lower border; they show the outside temperature, clock time and odometer readings as well as warning and information symbols. LEDs indicate the engine coolant temperature and fuel level.

Infotainment and Audi connect

The term “Audi connect” refers to all applications and developments that connect Audi models to the owner, the Internet, the infrastructure and other vehicles. Audi is steadily extending its lead in this field with new infotainment solutions and developments.

Audi connect

Audi is among the pioneers in the field of mobile networking. The company began its collaboration with key hardware and software suppliers back in 2005, and the Audi connect Internet services became available in cars for the first time in 2009.

Audi connect broadband Internet module

The Audi connect module featuring mobile broadband Internet access combined with a mobile WLAN hotspot is an innovative extension of the top-of-the-line MMI navigation plus system. Audi offers it throughout nearly the entire model range.

In 2010, Audi became the first carmaker to offer broadband Internet access via an integrated UMTS module for all models, and in 2013 took another step in the direction of mobile, high-speed Internet with the introduction of the fully integrated LTE module.

The integrated WLAN hotspot allows the car’s passengers to connect as many as eight personal mobile devices. To go online, drivers merely need to insert a data-capable SIM card into the MMI navigation plus unit’s card reader to go online. Alternatively, they can connect their cell phone to the system via Bluetooth if it is equipped with the necessary SIM Access Profile. Additional charges or separate contracts are not necessary; Audi recommends a flat rate, however, in view of the high amounts of data. Operation is via MMI navigation plus, the multifunction steering wheel or voice control. To provide the best possible reception conditions, voice and data signals are transmitted via the car’s roof-mounted antenna.

The LTE mobile communications standard

The cellular phone network is key global factor for the networking of automobiles. In most countries, mobile device data are transferred via UMTS networks (UMTS = Universal Mobile Telecommunications System). Depending on the configuration, the third generation (3G) of this mobile communications standard currently enables a transfer rate of up to 21 Mbit per second.

LTE networks (LTE = Long Term Evolution) are already available in several European countries and the United States. In Germany, the fourth-generation mobile communications standard is already active in all major cities and in rural areas. Audi brought LTE technology to the automobile in 2013: the latest generation LTE Audi connect module is used in the models of the A3 family. Further model lines will follow in the near future.

The fully integrated LTE module supports data rates of up to 100 Mbit/s downstream, 50 Mbit/s upstream and very short response times. This enables the transfer of large volumes of data, such as music and high-definition films, as well as short ping times for interactive applications such as games. Passengers in the new Audi A3 can run different applications at the same time on their mobile devices. One of them can participate in a conference call, for example, while another watches a video.

Thanks to the full integration of the module, it is not just mobile end devices that benefit from the high-speed receiver technology. It was important during the development process to not only provide a high-speed Internet connection mobile devices, but also to provide high-speed Internet access for the car's internal systems. This enables Audi connect services such as navigation with Google Earth and Google Street View to load and display much, much faster.

Full integration of LTE and the associated fast transfer of data will enable the targeted expansion of the Audi connect range in the years ahead, from cloud-based music services to car-to-X services such as wireless payment or communication with traffic signals. LTE makes it possible to provide these services everywhere, even in rural areas.

Audi connect services

Audi connect brings numerous tailored services to the car, such as online news, travel and weather information, and up-to-the-minute information on flight and train connections. In the Audi A3, they can be used with a convenient text-to-speech function.

Online traffic information presents current traffic flow data in real time on the navigation map. If the route chosen by the driver has free-flowing traffic, it is shown in green; orange indicates dense or slow-moving traffic, and red signifies a traffic jam. In this case, the service identifies the problem and suggests an appropriate alternate route.

The online traffic information service covers not only freeways, but also interurban roads and cities. It covers most European countries. The primary source of data for the database are smartphones and navigation devices that are in vehicles and report their current positions at short intervals to service providers via the cell phone network. The conditioned and anonymized data provide a detailed picture of the traffic load situation.

Navigation with Google Earth and Google Street View facilitates orientation on reaching the location considerably. Street View uses 360° panoramic images to provide the driver a street view of the destination prior to arrival. The navigation map is backed with images from Google Earth. Map zoom down to 30 meters is a unique feature here.

City Events is an Audi connect service that provides information on a multitude of events at the current location, a travel destination or a freely selectable location. Customers can filter according to various categories such as concerts or sporting events.

Flight and train information from Audi connect can be used to check departure times, track and gate numbers, and also obtain information on any delays. There is also a direct search function for finding specific flight numbers.

The Fuel prices service, which in Germany also draws information from the Market Transparency Office, lists the cheapest gas stations. In the Audi A3, it even considers the type of fuel required.

Among the newest Audi connect services is the Parking space information service. It displays parking lots and parking garages at the current location, at the destination or at any other location. Whenever possible, it also indicates the number of available spaces and parking fees. The parking lot address can be easily set as a navigation destination, and the surrounding area can be checked out in advance using Google Earth and Google Street View. Audi connect also integrates the online community services Facebook and Twitter in the infotainment system in a vehicle-specific way. In addition to the text-to-speech function, there is also a text function – predefined text modules can be sent, if desired, with data such as the current position. Like several other Audi connect services, Facebook and Twitter can be customized to the user's individual needs on their home PC using a myAudi account. In addition, received e-mail messages can be transferred from a cell phone to the car via Bluetooth and read aloud. The driver can dictate texts (SMS) and send them using voice commands.

Another service from Audi connect is Picturebook Navigation. With this service, the driver stores photos of destinations linked with geonavigation (GPS) data in the MMI navigation plus system's "photo box." The can be either personal photos or images from Google Street View. Images can be imported from an SD card or via a myAudi account. The photos can then be browsed in Cover Flow and entered as navigation destinations by reading out the linked GPS data.

Key Audi connect functions can be controlled via voice commands, including the point-of-interest (POI) search. The driver can speak the destination – city, street and house number – as a single sentence. The POI search also supports the use of keywords to find special destinations. The voice command is translated into a data packet and sent to the Google search engine. The hit list appearing on the MMI monitor often includes practical additional information such as telephone numbers or ratings.

Audi music stream is the Audi connect web radio. With this app and UPNP (Universal Plug and Play) technology, the user can receive broadcasts from more than 3,000 Internet radio stations. Personal favorites can be saved to a cell phone, and they can be played via the MMI navigation plus system. This Internet radio app is integrated via WLAN into the MMI navigation plus, and the car's sound system handles playback. The app also provides access to the media library stored on the user's smartphone.

Audi music stream is available either as an independent smartphone app or integrated into Audi MMI connect. This app, which is currently available for the A3 family, makes a number of additional services available on the mobile device. Audi MMI connect is thus the direct link to the car. Services such as the POI search, City Events and Picturebook Navigation can be used via the app and the search results or photographs sent directly to the MMI navigation plus unit in the car.

In future infotainment systems, a mobile app will integrate the online media services Napster (Rhapsody in the United States) and Aupeo! in the Audi connect portfolio into MMI. WLAN will be used to wirelessly transfer the services from the iOS or Android device to MMI. As with all Audi connect services, the user interface is integrated into the familiar human-machine interface (HMI), ensuring ease of use.

Audi connect - outlook

The role of the car in society is changing appreciably. It is increasingly moving from a status symbol to a mobile device, a technical device that enables the user to be always online even when underway. The fast LTE mobile communications network will provide a strong push to the subject of data in the cloud (the use of online data) and car-to-x communication. The brand is assuming a leading role in this development as well with its new Audi connect technologies.

Car-to-x communication

Car-to-x communication, another important aspect of Audi connect, opens up numerous new possibilities for making driving safer, more relaxed and more economical.

Cars that are networked together can warn one another about hazards such as slippery roads or cross-traffic at intersections, for example. Car-to-x communication is also extremely well suited for the dissemination of traffic information data. Automotive WLAN communication, in particular, can generate very precise and exact data.

Online traffic light information

Among the new car-to-x applications at Audi is the service Online traffic light information. It networks the car with the central traffic control computer that controls the traffic lights in the city. Targeted information appears in the display of the driver information system. It shows the driver the speed to select in order to reach the next traffic light during a green phase. The time remaining is displayed while waiting for the light to turn green.

Audi developed and tested the principle of the new Online traffic light information service as part of the Travolution project in Ingolstadt and the nation-wide field trial simTD (Safe and Intelligent Mobility Test Field Germany). It benefits not just the drivers by making traffic more fluid, less stressful and safer, but also the cities and the environment in which it is used. According to Audi's calculations, CO₂ emissions can be reduced by up to 15 percent. If deployed throughout Germany, this would correspond to a savings of roughly 900 million liters (237,754,847.12 *US gallons*) of fuel.

Audi is currently gathering additional experience in multiple field trials. In the northern Italian city of Verona, some 60 traffic lights covering nearly the entire city center are part of the trial. A field trial in Berlin involves a total of 1,000 traffic lights and 25 Audi cars driven by customers. No other carmaker is active on such a large scale. The principle is currently being demonstrated with 50 traffic lights in the American city of Las Vegas, Nevada.

Infotainment

The members of the A3 family are the first Audi models to have the modular infotainment platform (MIB) on board. When launched in 2012, it meant for Audi the start of a new era of infotainment. Even then its architecture met a challenge that is becoming increasingly pressing: Carmakers with their relatively long product life cycles must come to terms with the fast pace of consumer electronics in order to continue to meet customer needs and requirements in the future.

The modular infotainment platform

The central computer in the MIB brings two primary components together in a tight space: the Radio Car Control Unit and the MMX board (MMX = Multi-Media eXtension). Besides the memory and flash storage, the plug-in module also includes a fast Tegra processor from Nvidia that handles all online, media, voice command, navigation and telephony functions. The modular system concept enables Audi to keep the MMX board up to date as development continues and thus quickly bring the latest trends in consumer electronics to the car.

At the 2014 CES, Audi is therefore presenting the second generation of the MIB just one-and-half years after its market launch. Series production will begin during the course of the year. The updated modular infotainment platform uses the Nvidia Tegra 30 processor, a quad-core chip from the Nvidia Tegra 3 series. With a clock speed of over 1 GHz and a fast graphics card, it can drive two displays and perform eight billion operations per second. The T 30 processor works together with a 3D graphics program from the specialist Rightware. With this combination, Audi is the first carmaker with the capability of implementing and displaying three-dimensional graphics in its vehicles.

The next generation of processors is already waiting in the wings: the Nvidia Tegra 40, which is also a quad-core design. As in the previous chip, its power requirements are minimal – which fits in perfectly with Audi's efficiency strategy. The brand is also uncompromising with respect to manufacturing quality. The processors are rigorously tested for the harsh operating conditions in a car.

Nvidia plans to regularly release ever more powerful chips in the years to come, and Audi will introduce them in its cars soon after they appear thanks to the modular MIB concept. Audi is pursuing a broad scale program of component integration. The next big step in the development of the MIB will be the use of multi-chip modules (MCM).

Audi Phone Box

Audi offers the Audi phone box for easily connecting cell phones with the car as an option in the models of the A3 series. Its key component is a universal planar antenna, which is integrated into the center armrest's phone storage tray. The telephone uses near-field coupling to communicate with the flat planar antenna, which routes signals via an amplifier to the car antenna.

A future feature of the Audi phone box will be wireless charging – the brand is bringing contactless charging to production vehicles. Electricity flows from a coil in the floor of the Audi phone box via induction to the Qi standard to a receiver coil in the smartphone. The receiver coil can be integrated into the battery, a retrofittable film or the phone cover. The telephone can be used without restriction while charging and can be controlled via the MMI system in the accustomed Audi manner.

Audi Smart Display

Audi once again breaks new ground in the infotainment sphere with the Audi Smart Display. Comparable to a portable computer system, the 10.2-inch Smart Display is compact, yet high-resolution. An active, fast computer, it opens up entirely new dimensions in its role as a mobile in-car entertainment system.

From DVD and TV streaming to remote access in the car to multimedia content, and from control of the radio to route planning for the navigation system, the Audi Smart Display combines practicality and entertainment in one device, both inside and outside the vehicle.

The Smart Display is connected to the car via a WLAN link to the MMI navigation plus with Audi connect. Radio and media, navigation and even car data can then be shown on the device's touch display.

The unit's internal storage serves as an audio and video jukebox, but the Audi Smart Display can also receive video from the MMI navigation plus.

The Smart Display uses the Audi sound system to play back sound in perfect quality. External headphones can also be connected via Bluetooth or a standard headphone jack. The Smart Display also supports NFC (near field communication) technology, making it particularly easy to connect to Bluetooth headphones and mobile devices in general.

But the Audi Smart Display has even more to offer. Thanks to the WLAN connection, clicking on the “more” button in the start menu establishes an Internet connection with UMTS or LTE speeds via Audi connect.

The full functionality of the Android operating system is available. Google Play, the Android app store, provides access to more than 950,000 apps and games as well as movies, music, audio books and eBooks. The integrated camera in the Smart Display can be used for Skype video calls, and the QuickOffice app keeps users productive while on the road.

The Audi Smart Display was systematically developed for use in cars. It can easily withstand high and very low temperatures, and its brushed aluminum chassis visualizes the device’s premium character. All computing operations are extremely fast thanks to the new Tegra 4 processor from Nvidia, the heart of the device.

Lighting technology

Lighting technology is a field in which Audi is well ahead of the competition. The brand already offers LED headlights in many model series, and groundbreaking Matrix LED technology is now available in the new Audi A8. Audi's next steps will be laser headlights for the high beam and innovative interior lighting.

Lighting technologies of today

Design and technology – headlights of every Audi model define the appearance of the cars, and because they illuminate the road so well, they also make a major contribution to active safety. With its numerous innovations, Audi has raised the profile of lighting technology in the international automotive industry.

In 1994, xenon headlights in the Audi A8 replaced the halogen lamps typically used. The sedan added adaptive light and LED daytime running lights in 2003 and 2004, respectively. Audi established another milestone in 2008 with the introduction of all-LED headlights in the R8 supercar. Today this technology is available in numerous models, including the A3 family. In 2010, the adaptive light was networked with navigation data for the first time in the Audi A8.

adaptive light

With adaptive light, which is available in a variety of configurations, a control module controls the swiveling xenon plus modules so that they always deliver the ideal illumination for city, highway and freeway driving. The driver can configure the swivel characteristics via the Audi drive select vehicle dynamics system. The all-weather light in the main headlights replaces the fog lights and provides for a longer range, a wider lateral illumination pattern and reduced glare.

A particularly attractive component of the adaptive light is the variable headlight range control. A video camera recognizes preceding and approaching vehicles by their lights. The control module then adapts the car's lighting to the distance to the other vehicles – via a soft transition that always maximizes the amount of illumination.

Networking with the MMI navigation plus system makes the adaptive light even more capable. The navigation system reads the route data in advance and relays them to the light computer so as to activate the highway lighting while still in the approach lane, for example. The system automatically switches on the cornering lights before entering an intersection, and in countries like the United Kingdom, it automatically switches the headlights from driving on the right to driving on the left.

LED daytime running lights and LED rear lights

Daytime running lights comprising white light emitting diodes are available in different designs for each model. The Audi A1, for example, uses two LEDs per headlight. They emit their light into a transparent polymer tube, the light guide, which generates a uniform contour. In the Audi A7 Sportback, the daytime running lights of the optional LED headlights also appears to be linear, but are generated by 18 individual LEDs behind a polymer body.

Audi also offers rear lights using LED technology either standard or as an option for all models. They produce a distinctive light pattern that in many cases also produces three-dimensional effects. The light-emitting diodes reach their full light intensity almost instantaneously – if a driver has to brake suddenly, drivers following the Audi gain valuable fractions of a second.

Dynamic turn signals

Audi offers dynamic turn signals in the R8 and the A8. In the sedan, a strip of 18 light-emitting diodes divided into seven blocks is located at the bottom and outer edge of each headlight. In each of the rear lights, there are 24 LEDs in eight segments.

When blinking to signal a turn, the blocks are sequentially activated at 20 millisecond intervals, from the inside outwards. After 150 milliseconds, all segments are bright; For another 250 milliseconds they illuminate with full intensity. The turn signals then go dark before repeating the lighting sequence. Because the new Audi turn signals also visualize the turning direction, they send an intuitive signal that can be quickly recognized even at a great distance.

LED headlights

LED headlights from Audi produce a light that, with a color temperature of around 5,500 Kelvin, resembles daylight and is thus easier on the eyes. The LEDs are maintenance-free and designed to last the life of the car. The low beams consume only around 40 watts per unit, somewhat less than the already highly efficient xenon plus headlights. The LED headlights have special features for the city, intersections and interurban roads as well as for freeway driving, left-hand traffic and poor weather.

Audi showcases the technology's beauty with the design of the LED headlights. In the A3 series, eight high-performance LEDs in the matte aluminum trim provide the high beams; nine high-performance LED chips in two free-form reflectors generate the low beams. The static turning and all-weather lights are housed in a separate module, and the daytime running lights, parking lights and turn signals are generated by a light guide that runs as a narrow strip along the upper and inner edge of the headlights.

LEDs do not get particularly hot. Red light-emitting diodes reach about 120 and white ones 150 degrees Celsius – much less than halogen headlights, which generate temperatures of up to 400 degrees Celsius. Fans ensure that the heat of the LEDs is transmitted to the headlight glass to keep it as free as possible of snow and condensation in winter.

In the Audi A8, the LED headlights interact with the optional night vision assistant to provide an additional function which helps to ensure even greater safety. When the night vision assistant detects a person in the critical area in front of the car, individual LEDs blink three times in quick succession. This highlights the person against the background, warning both them and the driver.

Audi Matrix LED headlights

The Audi Matrix LED headlights in the new A8 made their debut at the International Motor Show (IAA) in Frankfurt and represent the cutting edge of production technology. Their light, which has a specific shine, always delivers excellent illumination without blinding other road users. The high beam is broken up into 25 small light-emitting diodes per headlight. Groups of five shine through a common reflector.

When the light switch in the Audi A8 is set to Automatic and the high beams are on, the system is switched on outside of urban areas at speeds of 60 km/h (18.64 mph) and above. As soon as the camera used by the high beam detects another vehicle, the new headlights switch off or dim individual LEDs in the blink of an eye. Oncoming and preceding vehicles or road users are excluded from the light pattern and are not blinded, while all other areas between and adjacent to them continue to be fully illuminated. As soon as the oncoming traffic has passed, the high beam once gain illuminates the previously excluded sectors with full power.

The LEDs in the Matrix LED headlights also assume the function of cornering lights, selectively brightening or dimming to shift the focal point of the light along the curve. They do this shortly before the wheel is turned based on predictive route data provided by the MMI navigation plus. The light guides the driver into the curve.

Lighting technologies – outlook

Audi is already developing the lighting technologies of tomorrow. Three central themes are emerging. The Audi lighting of the future will react even more intensively to environmental conditions, it will communicate in various ways with its surroundings and thereby help to further increase active safety. With the Matrix LED headlights, Audi has already indicated that the lighting of the future will feature full-electronic control, making new dynamic features even more versatile.

Laser high beams

The laser light, which Audi is unveiling at the 2014 CES as the next step in headlight technology, has the potential to complement the LED high beam. It will make its debut in Audi's new Le Mans race car in June 2014, continuing the brand's tradition of testing its new technologies on the race track, the world's toughest proving grounds.

Laser diodes emit a monochromatic and coherent light with a wavelength of 450 nanometers. In its natural form it has a bluish shimmer. A phosphor-coated film in front of the diode converts it into a white light suitable for automotive applications.

Just a few micrometers in diameter, the laser diodes are even smaller than LED diodes and come very close to the theoretical ideal of a high-output, point light source for use in cars.

in the Audi Sport quattro laserlight concept show car, which Audi is displaying at the CES, the high beam produced by the laser diodes is three times as bright as the LED high beam. With a range of nearly 500 meters (*1,640.42 ft*), it reaches nearly twice as far – a major safety plus for the driver. Because the light beam is tightly bundled, laser diodes are not currently suitable for wide, low-beam light.

Interior lighting scenarios

There are many aspects to interior lighting. First, it provides functional value by making it possible to read and work at night and to find objects in storage compartments. But interior lighting is more than just functional; it contributes to a sense of well-being in the cabin and stirs emotions. The ambient lighting in the Audi A8 is a particularly successful example of this. In the near future, interior lighting developers will be able to add additional aspects: interaction with the surroundings and communication with the driver. The light will become part of the HMI (human-machine interface), the car's interface with the person.

Audi's LED and OLED technology is ideally suited to this purpose. Small diodes could illuminate the steering wheel rim, for instance. A green light could indicate to the driver that piloted driving is active, and red light could be a call for increased attentiveness at an intersection, for example. A red light in the door liner could warn against opening the door because a cyclist is about to pass. The wrap-around, the long arc below the windshield in many Audi models, could assume similar functions.

In the medium term, Audi plans to link intelligent interior lighting to innovative exterior lighting. In this scenario, lights on the driver's door and its door handle would switch on as the driver approaches the car. When the driver gets in, the light follows them into the cabin, tracing important contours such as the steering wheel and the instrument cluster.

The Solunar study

With the Solunar study, Audi demonstrates the custom use of light in the cabin. It provides insight into the subject of light in an urban context and presents ideas and technologies for the customization of light in the automobile. Solunar uses light throughout the entire cabin and even in the floor of the car. It adapts to the driver's style. The cabin becomes brighter while driving slowly in urban traffic and is more darkly illuminated during fast freeway driving. The light also takes on interface functions vis-à-vis the driver. One possibility is a turn arrow on the carpet as navigational information. One unique feature is the linking of interior lighting with innovative exterior lighting. For example, the marker light in the cabin passes into the engine hood to become exterior lighting.

Progressive Engineering

From the use of semiconductors in controllers to the development of plug-in hybrid models: Audi thinks progressively, far beyond the here and now. Audi places technical progress into an overall societal context in the Audi Urban Future Initiative, a think tank dedicated to the urban mobility of the future.

The Progressive Semi Conductor Program

Many innovations that Audi brings to the automobile are tightly linked to progress in microelectronics. Semiconductors are finding their way into virtually all areas and functions of the vehicle. Over 6,000 chips are now used in the large Audi model. This massive increase in distributed functions calls for high data rates for the data networks within the automobile and the best possible integration of the individual domain computers.

Audi places extremely stringent requirements on the chips, particularly regarding criteria such as durability, long-term quality and function over a wide temperature range. The bar is particularly high with innovations such as Nvidia's new Tegra graphic chips, which Audi chose to use in its cars shortly after the chips were launched. In light of this, Audi operates the Progressive Semi Conductor Program (PSCP), which is a key factor in future innovations.

Audi is breaking new ground with the PSCP, which was launched in late 2010. The system supplier remains an important contact, but Audi's engineers now also talk directly to the semiconductor manufacturers.

The intensive dialogue leads to higher efficiency and effectiveness as well as to compelling innovations at short intervals that are coming closer and closer to matching the high pace of the consumer electronics industry. In order to deepen its knowledge and manage development even more effectively, Audi is developing its own in-house semiconductor technology expertise.

The Audi A3 Sportback e-tron

The A3 Sportback e-tron from Audi is a latest-generation plug-in-hybrid car. The four-door premium compact, which is rolling into dealerships this year, combines sporty power with impressive efficiency and joy of driving with everyday practicality. It combines the best of both worlds: an electric range of 50 kilometers with the usual action radius of a fuel-efficient gasoline engine. The Audi A3 Sportback e-tron accelerates from zero to 100 km/h (*62.14 mph*) in 7.6 seconds and reaches a top speed of 222 km/h (*137.94 mph*). In accordance with the ECE standard for plug-in hybrid vehicles, its average CO₂ emissions are a mere 35 grams per km (*56.33 g/mile*) – a consumption of 1.5 liters of fuel per 100 km (*156.81 US mpg*).

Drivetrain

The 1.4 TFSI combustion engine is one of Audi's most modern power units. With 100 kW (150 hp) and 250 Nm (*184.39 lb-ft*), it offers ample power. It supplies peak torque across the entire speed range from 1,750 through 4,000 rpm, thus harmonizing excellently with the electric motor. The maximum of 330 Nm (*243.40 lb-ft*) is available virtually immediately and up to about 2,200 rpm. Maximum output is 75 kW. The system output of the A3 Sportback e-tron is 150 kW (204 hp), system torque is 350 Nm (*258.15 lb-ft*) and total range is 940 km (*584.09 miles*).

The 1.4 TFSI is mounted in a special position to create space for the high-voltage components. Its crankcase is made from diecast aluminum, and total weight is just over 100 kg (*220.46 lb*). The four-cylinder engine is state of art in every respect. Take thermal management, for example: The exhaust manifold is integrated into the cylinder head. After a cold start, it brings the coolant swiftly up to operating temperature. At high loads, the water jacket lowers the temperature of the exhaust gas.

Thanks to the high electric range of up to 50 km (*31.07 miles*), many customers will only rarely experience the gasoline engine of the Audi A3 Sportback e-tron in action. Another effect of the plug-in hybrid concept is that the TFSI is often only activated in kickdown situations, i.e. it is subjected to high loads while still cold. The engine therefore is equipped with protective features such as modified cylinder linings and piston rings.

The electric motor is a liquid-cooled, permanently excited synchronous machine. It is located between the engine's dual-mass flywheel and the newly developed separating clutch, the K0 clutch. When the TFSI starts, it is tow-started by the electric motor via the clutch. As soon as the TFSI reaches the same speed as the electric motor, the clutch closes within roughly half a second.

Together with the K0 separating clutch, the electric motor is integrated into a newly designed six-speed e-S tronic, which transfers the power to the front wheels. Like all Audi dual-clutch transmissions, it consists of two subsidiary transmissions that are served by the two multi-plate clutches K1 and K2. Gears are shifted by switching the clutches. This happens within a few hundredths of a second and with no detectable interruption of propulsive power.

Battery

The lithium-ion battery in the Audi A3 Sportback e-tron can store 8.8 kWh of energy, more than 70 percent of which is useable. Depending on the level of charge, the voltage ranges between 280 and 390 volts. The battery consists of 96 prismatic cells arranged into eight modules of twelve cells each. Including its electronic components, the battery system weights 125 kilograms (*275.58 lb*).

An elaborate liquid cooling system ensures that the battery is kept within a suitable temperature range during operation. Electric driving is possible regardless of the outside temperature, in summer and in winter. The cooling system represents a separate low-temperature circuit in the car and runs on a separate cooler housed in the engine compartment. It can also be coupled with the air conditioning system, if necessary.

In the event of a crash sufficiently severe to trigger the belt tensioners or airbags, the entire system is disconnected from the power supply. The flat-shaped battery is installed under the rear bench seat – an area where the high-strength and ultra-high-strength steel components of the occupant cell form an especially strong structure. Its housing and interior structure are equally of a very sturdy design. The 12-volt battery for the low-voltage consumers and the fuel tank are located above the rear axle. The two components barely impinge on the luggage compartment, which in the standard configuration measures 280 liters (*9.89 cu ft*) and 1,120 liters (*39.55 cu ft*) with the rear seat backs down.

Charging

Audi supplies the A3 Sportback e-tron with a universal charging cable suitable for use with both domestic and industrial power sockets. The connecting plugs are country-specific in design. For use in a home garage, the cable can be clipped into a wall-mounted holder. It takes slightly more than two hours to charge the battery fully from an industrial power socket and about three hours and 45 minutes from a European domestic power socket.

Audi has partnered with a supplier of renewable energy, as electric driving only makes ecological sense with electricity generated from renewables. Another of the brand's medium-term projects is automatic charging without physical contacts, referred to as Audi wireless charging. In this case, charging is performed inductively via an alternating magnetic field between a stationary charging pad on the ground and a charging pad in the car, similar to the principle used by an electric toothbrush.

When the cable is used for charging, the electricity flows to the charging connection located behind the four rings in the Singleframe grille. In addition to a status LED, there are also two pushbuttons that allow the user to choose between timer-controlled charging and immediate charging. The charger in the car converts the incoming alternating current into direct current for the battery.

Components for electric driving

The power electronics, located in the engine compartment, then convert the battery's direct current into three-phase current for the electric motor via six high-performance transistors. With a volume of eight liters (*0.28 cu ft*) and a weight of 10 kilograms (*22.05 lb*), the power electronics, which include a DC/DC converter for connecting up the vehicle's 12-volt electrical system, are compact and light in weight. Together with the charger, it is incorporated into the same cooling circuit as the traction battery.

There are yet more special components for electric driving. The air conditioning compressor has an electric drive integrated into the high-voltage network. A thermoelectric heating element and a gasoline-powered auxiliary heater round off the interior heating system.

The vacuum brake servo is also electronically controlled. The hybrid management system ensures that it functions in harmony with the electric motor. At up to medium braking loads, most of the braking work is performed by the electric motor, which is now functioning as a generator. The energy that it recovers is fed into the traction battery. The wheel brakes only become active if the driver presses the pedal more forcefully.

Operating modes

Braking recuperation is one of several operating modes of the Audi A3 Sportback e-tron. The car is almost always driven electrically, except in extreme cold or heat or when battery charge is very low. The electric motor's high torque accelerates the sporty compact in 4.9 seconds from 0 to 60 km/h (*37.28 mph*) with quiet but forceful propulsion.

In electric mode, the Audi A3 Sportback e-tron can travel at up to 130 km/h (*80.78 mph*). When driving at a constant 100 km/h (*62.14 mph*), generally only the electric motor is active provided that there is sufficient energy in the battery. As soon as the driver steps hard on the accelerator, for instance to pass, the TFSI cuts in and both drive systems provide boost. When the driver releases the accelerator at high speed, the hybrid management system switches into gliding mode. Now both drives are completely deactivated and are no longer generating braking torque. When stepping off the accelerator at medium and low speeds, the system recovers energy through coasting recuperation.

The driver has several ways of actively managing the vehicle's response. They can choose from three programs using a button in the cockpit or the e-S tronic selector lever. The EV characteristic map gives priority to electric drive; in the S program, the Audi A3 Sportback e-tron is very sport. The "Charge" button is used to charge the battery as quickly as possible.

The hybrid hold mode can be selected via a menu in the MMI. This mode preserves the electrical energy stored in the battery for later use, such as urban driving in the destination city. The driver can also influence hybrid operation via the Audi drive select system. Different levels of coasting recuperation are assigned to the four modes available there.

The Audi A3 Sportback e-tron displays supply information about the driveline status. The powermeter in the instrument cluster shows the system's overall output, as well as the status of the driveline and the battery charge. The monitor for the MMI navigation plus shows the energy flows in the hybrid system. In addition, the driver information system displays the operating ranges and consumption figures for electricity and gasoline.

Online services

Under the Audi connect umbrella, Audi is currently developing an entire portfolio of innovative online services for the A3 e-tron. Drivers can use these to monitor and manage a wide range of functions via their iOS or Android smartphone.

For instance, they can call up the car's status – such as the battery's momentary charge status, the electric range or even its parked location. Drivers can control the charging planner remotely from their cell phone. They can start and stop the charging process or set the charging timer for the desired departure time. They specify in detail at what time on what days they want to drive off with the battery fully charged.

The climate control planner works similarly. The owner can, for instance, program a desired departure time. The car's cabin temperature is then brought to the preset temperature automatically during the charging process, thus there is no reduction in range for the trip itself. Finally, the web portal gives the owner the chance to review their trip data, e.g. power consumption, distance driven and speed.

Weight

Thanks to Audi's ultra lightweight construction philosophy, the Audi A3 Sportback e-tron complete with all electrical components has a curb weight of less than 1,580 kilograms (3,483.30 lb) while offering space for five occupants and plenty of cargo. It comes complete with all the brand's strengths – elegant design, sporty chassis, top-notch ergonomics, excellent build quality and an extensive choice of high-end assistance and infotainment systems. The Internet connection is via the high-speed LTE standard. Audi is the first carmaker to completely integrate this standard into the automobile.

Audi Urban Future Initiative

The world is changing at a fast pace, and populations are growing rapidly. In the year 2030, it is estimated that 60 percent of all people will live in metropolitan areas with over eight million residents, primarily in Asia and South America. Audi has been posing questions about these trends, and in 2010 it founded the Audi Urban Future Initiative.

The initiative is an interdisciplinary forum that networks creative thinkers with one another across the globe – architects, sociologists, urban planners and trend researchers. It brings together specialists from different disciplines, cultures and perspectives. Together, they analyze the challenges related to mobility in the world's megacities, and they enter into dialog with urban developers to jointly seek out new solutions.

The findings and ideas that result from the Audi Urban Future Initiative address technical issues, but they also consider social, environmental and aesthetic aspects. The range of topics is as multifaceted as the world's megacities themselves. The central focus is always on networking between the automobile and the city in the framework of a new, intelligent mobility.

Today, Audi already offers a large bandwidth of technologies and services. They begin with Car-to-X technology, Audi traffic light info online and cover the services of Audi connect – Audi traffic information online, the City Events service and parking space information. Other technologies include piloted driving, which is approaching production readiness, for stop-and-go driving in traffic jams as well as parking and wireless payment in parking structures.

Many other ideas exist for the future. In the Audi Urban Intelligent Assist scenario, for instance, the car serves as an intelligent assistant to people. The ideas and projects range from a navigation system that talks to the driver in a natural way and in easy-to-understand terms to early information on traffic flow, parking options and the weather. The car is not only a data receiver; it can also assume the role of a sender – it can send information such as the address of a meeting location directly to a customer's smart phone and start pedestrian navigation.

At CES, the Audi Urban Future Initiative is putting an interactive high-tech city model on display which presents the issues and findings of the City Dossier Boston project. This dossier bundles facts and ideas that Audi developed together with the architectural firm Höweler & Yoon of the USA. The architects from Boston, Massachusetts won the Audi Urban Future Award in 2012. The 100,000 dollar prize is the highest of any architectural competition in Germany.

The interface of the interactive city model at CES models urban mobility – the traffic flows, data streams and changes to the infrastructure and the urban space. In the city, visitors can experience the various types of commuters described in the City Dossier Boston. The “Road Warrior” and the “Reverse Commuter” drive their cars from their apartments to their workplaces – the one resides at the outskirts of the city and commutes into the city, while the other travels in the opposite direction. The “Strap Hanger” commutes to the city center or to another city district by public transportation. The interactive city model at the CES gives visitors an impression of how visionary technologies can improve and simplify commuting.

In 2014, the Audi Urban Future Award will be held for the third time – with interdisciplinary innovation teams from three continents, in which game designers are as involved as urban planners, start-ups, IT specialists and scientists. Located in different cities, they develop feasibility studies in the framework of existing mobility projects.

In a preliminary round of the competition, three teams from the USA are competing head-to-head. Each team is examining, in a different way, the question of what role data can play as a planning tool in the urban space. According to the common thesis, data can be used to decisively assist in shaping the cities of the future and establishing new connections between people, mobility and architecture. The selection of the victorious team is made in the context of a “speed pitch” on the Internet. Audi Chairman of the Board Prof. Rupert Stadler will introduce the winning concept at the 2014 International CES in Las Vegas, Nevada.

Audi cars at the CES

Audi uses the CES, the world's most important electronics trade show, as a stage for its innovations, including vehicle models. At the show this year are the A3 Sedan, the A3 Cabriolet, the new Audi S8 and the Audi Sport quattro laserlight concept, which is making its world premiere in Las Vegas.

A tradition of futuristic technology – The Audi Sport quattro laserlight concept show car

An evolution of the Sport quattro concept, the plasma red coupe combines the power of the historic Sport quattro with dramatic elegance. Its body is perched tautly over the large wheels. The overhangs are short, the proportions sportily balanced. With a wheelbase of 2,784 millimeters (*109.61 in*), it is 4,602 millimeters (*181.18 in*) long. With 1,964 millimeters (*77.32 in*), the two-door model is very wide and at just 1,386 millimeters (*54.57 in*) extraordinarily low-slung.

With the double headlights, a typical quattro feature, Audi demonstrates the future of lighting technology with a combination of LED and laser light. Two flat, trapezoidal bodies can be seen inside the headlights. The outer body uses LEDs and a diaphragm to produce the low beam; the inner body produces the laser high beam. The high-performance laser diodes are significantly smaller than LED diodes, measuring just a few micrometers in diameter. With a range of nearly 500 meters (*1,640.42 ft*), the laser high beam shines roughly twice as far and three times brighter than an LED high beam. Audi once again underscores its leading role in automotive lighting with this pioneering technology, which will also be used on the race track in 2014 in the R18 e-tron quattro.

The flat, angular C-pillars of the Audi Sport quattro laserlight concept and the blisters over the fenders are further design cues reminiscent of the classic Sport quattro. The broad, boldly sculpted shoulders have been reinterpreted to make the chassis more dynamic than ever. Throughout the car, sharp contours frame tautly muscular surfaces. The interplay between convex and concave curvatures define the coupe's athletic character.

The hexagonal Singleframe grille also provides a glimpse at the future design of the sporty production models. Its lower section is nearly virtually upright; the upper section follows the line of the engine hood. The grille insert is a typical racing solution. The low grille emphasizes the width of the show car. Two large, vertical blades divide each of the massive air inlets. Their form is taken up by the creases in the engine hood. The splitter made of carbon fiber-reinforced polymer (CFRP) is placed far to the front, as with a race car.

At the rear of car, the combination of the flat greenhouse and the broad shoulders define the proportions. Another distinctive element is the CFRP diffuser, which extends far upward. Its upper section is honeycombed, whereas the lower section houses two large, oval tailpipes. Mounted on a black CFRP facing, the tail lights are rectangular – another quattro styling cue. A solid crossbeam reinforces the luggage compartment, which has a capacity of 300 liters (*10.59 cu ft*).

Finely penned details round out the dynamic look of the Audi Sport quattro laserlight concept. The flared sills are made of CFRP; the power door handles extend automatically to meet an approaching hand. The center-locking wheels feature a five twin-spoke design.

Lightweight construction exemplified: the interior

The theme of elegant sportiness carries over into the generous interior of the show car with dark gray tones and clean lines. The design and choice of materials demonstrate Audi's lightweight construction philosophy. Viewed from above, the slim instrument panel is reminiscent of the wing of a sailplane. The support structure of the interior is a CFRP shell that also serves as a storage compartment in the doors.

A line below the windshield encircles the driver and passenger, and includes functions such as the door openers. The competition bucket seats with folding backs, high side bolsters and integrated head restraints together with the two rear seats offer space for four. The air conditioning control unit is integrated into the air vents. Intensity, temperature and air flow can be controlled using a single element. The slim display in the center air vent displays media data in addition to the air conditioning settings.

New solutions: display and control elements

The interior of the Audi Sport quattro laserlight concept is focused entirely on the driver. The multifunction sport steering wheel hints at future sporty production solutions. It has two buttons that enable the driver to influence the hybrid drive system, a red start-stop button, a button for the Audi drive select system and a "View" button for controlling the Audi virtual cockpit.

All key information is displayed on the large Audi TFT display in high-resolution graphics with a three-dimensional effect. A cutting-edge Tegra 30 processor from Audi's partner Nvidia renders the graphics. The driver can switch between different modes. In MMI mode, displays such as the navigation map or media lists dominate; in the classic view, the speedometer takes center stage.

Nearly every function of the Audi Sport quattro laserlight concept can be controlled via the updated MMI terminal on the center tunnel console. Its large rotary/push button control, which also serves as a touchpad, can be moved in four directions. Four buttons – Main Menu, Function Menus, Options and Back – are arranged around it on three sides. The new control system corresponds with a menu structure whose intuitive character is reminiscent of a smartphone. All frequently used functions can be accessed extremely quickly. Most text input can be completed in just a few steps thanks to a new free text search function. Four characters are generally all that are required for a navigation address. The driver can quickly scroll through lists or zoom in and out of the map using multitouch gestures on the touchpad. Voice control has also been thoroughly updated.

Powerful and highly efficient: the drive system

The plug-in hybrid drive makes the Audi Sport quattro laserlight concept stunningly dynamic. System output is 515 kW (700 hp); system torque is 800 Nm (*590.05 lb-ft*). Power flows through a modified eight-speed tiptronic to the quattro powertrain, which features a sport differential on the rear axle. According to the applicable fuel consumption standard, the show car consumes on average 2.5 liters of fuel per 100 kilometers (*94.09 US mpg*), a CO₂ equivalent of 59 grams per kilometer (*94.95 g/mile*). The combustion engine is a 4.0-liter biturbo V8 developing 412 kW (560 hp) and 700 Nm (*516.29 lb-ft*) of torque. The cylinder on demand (COD) system, which deactivates four cylinders under part load, and a start-stop system make the sonorous eight-cylinder unit very efficient.

Located between the 4.0 TFSI and the transmission is a disc-shaped electric motor producing 110 kW and 400 Nm (*295.02 lb-ft*). It draws its traction energy from a rear-mounted lithium-ion battery with a capacity of 14.1 kWh, enough for an electric range of up to 50 kilometers (*31.07 miles*). It is charged via an Audi wall box, which ensures the optimal feed of energy.

An intelligent management system adjusts the interplay between the engine and electric motor as needed. The driver can switch between three different modes. In EV mode, only the electric motor is used. With its high torque, it propels the show car strongly even outside the city. The active accelerator pedal uses a change in resistance to indicate the transition to hybrid mode so that the driver can consciously control this.

Hybrid mode is focused on the interplay of the TFSI engine and electric motor to achieve optimal fuel consumption using environmental and route data. The driver can actively influence the operating strategy via the Hold and Charge function in the MMI system, for instance to ensure that there is electrical energy available for the last few kilometers at the destination. The Audi drive select system offers further control options, with different levels of recuperation assigned to the individual driving profiles.

In Sport mode, the operating strategy sets the drive system for maximum performance. With both the V8 and electric machine engaged, the Audi Sport quattro laserlight concept accelerates from 0 to 100 km/h (*62.14 mph*) in 3.7 seconds and reaches a top speed of 305 km/h (*189.52 mph*).

Body and chassis

The Audi lightweight construction concept also plays a large part in this dynamic performance. In the passenger cell, ultra-high-strength steel sheets and cast aluminum structural elements are combined together. The doors and fenders are made of aluminum; the roof, engine hood and rear hatch of CFRP. The result is a curb weight including the battery pack of just 1,850 kilograms (*4,078.55 lb*).

The front suspension comprises five control arms per wheel; the rear suspension follows the Audi track-controlled trapezoidal link principle. This guarantees dynamic handling and stability. Tautly tuned springs and dampers keep the Audi Sport quattro laserlight concept firmly connected to the road.

Audi drive select makes the driving experience even more versatile. The dynamic steering varies its ratio as a function of driving speed. The brake calipers grip large, carbon fiber-ceramic discs, and the tire format is 285/30 R 21.

Dynamic four-door compact – the Audi A3 Sedan and S3 Sedan

With the launch of the sport A3 Sedan in late summer, Audi entered the world's largest market segment, the four-door compact class. The third model of the successful A3 series impresses with a low weight thanks to lightweight construction, powerful and highly efficient engines, and numerous high-end infotainment and driver assistance solutions. The top model is the S3 Sedan with 221 kW (300 hp).

The Audi A3 Sedan, the first notchback model from Audi in the compact premium segment, boasts a fascinatingly sporty character. It owes its sportiness to the low weight. Thanks to Audi's lightweight construction technology, the four-door model equipped with the 1.4 TFSI and S tronic has a curb weight of 1,250 kilograms (2,755.78 lb). In the occupant cell, many components are made of hot-shaped, high-end steel. The engine hood is made of aluminum. The engines and chassis also set standards with their low weight.

The design of the 446 centimeter-long (15.29 ft) Audi A3 Sedan combines the classic three-box concept with the dynamics of a coupe. The flat roof ends in C-pillar that flows smoothly into the shoulder of the body. The tornado line forms a stark shadow contour, and the fenders are strongly flared.

As with every Audi, the Singleframe grille is the most distinctive element of the front end. The bumper, which tapers into a striking, horizontal contour, and the large air inlets underscore the width of the A3 Sedan. The new Audi can be optionally equipped with all-LED headlights, which are a technical and visual highlight. The tail lights are also available with light-emitting diodes.

The interior of the sporty four-door features a light and clean design. The instrument panel is slender, and the center console is angled towards the driver. The large, round air vents, the three-dimensionally styled inlays and the elegant control panel for the air conditioning system document the attention to detail with which Audi builds its cars. As with every model, the controls are simple and intuitive. The large, 425-liter (15.01 cu ft) trunk can be expanded by folding down the rear seatbacks.

Audi offers the A3 Sedan with TFSI and TDI engines. They displace 1.4, 1.8 or 2.0 liters and produce between 92 kW (125 hp) and 132 kW (180 hp).

All of the engines combine power with astonishingly low fuel consumption. A special highlight is the cylinder on demand (COD) technology in the 1.4 TFSI; it shuts down two cylinders at low load.

The A3 Sedan is also at the front of its class when it comes to power transmission. Depending on the engine, it is equipped with either a manual gearbox or the S tronic. When combined with Audi drive select, the dual-clutch transmission includes a free-wheeling function that reduces fuel consumption. quattro permanent all-wheel drive will follow after the market launch.

Behind the sporty character of the Audi A3 Sedan is a finely balanced axle load distribution (59:41 front to back) and sophisticated chassis technology. Some of the components of the MacPherson front suspension are made of aluminum; the four-link rear suspension handles longitudinal and transverse forces separately. The sensitive power steering has an efficient electromechanical drive; Audi offers variable-ratio progressive steering as an option. During fast cornering, the electronic limited slip differential, an intelligent function of the electronic stabilization control (ESC), makes handling even more fluid and safe.

The A3 Sedan can be optionally equipped with the Audi drive select system (standard with the Ambition trim line). The driver can use this system to modify engine management, power steering and S tronic operation over several modes. Besides Audi magnetic ride active damper control, two sport suspensions are available. Wheels range in size from 16 to 19 inches, with the latter available only in combination with the sport suspension and Audi magnetic ride.

Groundbreaking: Infotainment

Audi offers A3 Sedan customers a complete system of infotainment modules, topped by the Bang & Olufsen sound system and MMI navigation plus. The latter's super-slim, seven-inch monitor extends electrically from the instrument panel. The user terminal has a rotary/push button control that is designed as a touchwheel with MMI touch – the touchwheel's top surface is a touch-sensitive pad for inputting alpha and numeric characters.

The Audi connect system supplements MMI navigation plus perfectly. It establishes a connection to the Internet using the fast LTE transmission standard whenever possible, which enables download rates of up to 100 Mbit per second.

With this innovation, Audi once again underscores its leading role in mobile infotainment.

The WLAN hotspot provided by the system enables passengers in the A3 Sedan to surf and e-mail freely. The driver can use tailored Internet services integrated into the car. These range from navigation with Google Earth images and Google Street View to online traffic information to Facebook and Twitter. Another service is parking information, which displays parking lots and parking garages.

The broad range of assistance systems is another strength of the A3 Sedan. The range begins with adaptive cruise control and extends through Audi side assist, Audi active lane assist, traffic sign recognition the park assist with 360° display to the safety system Audi pre sense basic. The driver information system with rest recommendation is standard in the sporty and comfortable trim lines Ambition and Ambient; it is available as an option in the base Attraction trim line.

The interior colors also vary according to the trim line. The S line sport package for the Ambition line bathes the interior entirely in black. Available upholstery materials include fabric, a mix of fabric and synthetic leather, Milano leather and a combination of Pearl Nappa leather and Alcantara. Individual options such as adaptive light and the panoramic glass roof are taken directly from the luxury class.

221 kW (300 hp): the Audi S3 Sedan

The top-of-the-line model is the Audi S3 Sedan. Its 2.0 TFSI engine produces 221 kW (300 hp) and 380 Nm (*280.27 lb-ft*) of torque. With the six-speed S tronic, the sprint from 0 to 100 km/h (*62.14 mph*) takes just 4.9 seconds; with the manual gearbox 5.3 seconds. Speed is electronically governed at 250 km/h (*155.34 mph*). When paired with the S tronic, the four-cylinder turbo consumes on average just 6.9 liters of fuel per 100 km (*34.09 US mpg*).

The heart of the quattro powertrain is an electronically controlled, multi-plate hydraulic clutch. The suspension lowers the body 25 millimeters (*0.98 in*). Large brakes are mounted behind the 18-inch wheels. 19-inch wheels are optionally available in conjunction with Audi magnetic ride. Progressive steering is standard in the S3 Sedan.

Instantly at the top of its class – the new Audi A3 Cabriolet

The new Audi A3 Cabriolet has a sporty stance on the road. It is significantly larger compared to the previous model: its length increased from 4.24 to 4.42 meters

(*13.91 to 14.50 ft*), its wheelbase from 2.58 to 2.60 meters (*8.46 to 8.53 ft*) and its width from 1.77 to 1.79 meters (*5.81 to 5.87 ft*). Yet, the base version of the A3 Cabriolet weighs just 1,345 kg (*2,965.22 lb*); that is around 60 kg (*132.28 lb*) lighter than before. In the occupant cell, many components are made of ultra-high-strength steel, and the engine hood is made of aluminum. Audi lightweight design competence was also applied to the engines and the chassis.

The extended rear overhang plays a key role in the harmonious proportions of the two-door car. Aluminum trim strips wrap around the windshield frame and the edge of the body; the car's sides are defined by precise lines and athletically taut surfaces. The flat headlights give the face of the car a resolute look, just as the air intakes and bumper emphasize the width of the A3 Cabriolet. Audi also offers the headlights in LED technology as an option.

The new A3 Cabriolet is available with a lightweight soft top. With the standard electrohydraulic drive, the top opens or closes in 18 seconds, even while driving at speeds up to 50 km/h (*31.07 mph*). When the top is down, it rests in a variable tray. An acoustic top is available as an alternative; it has a thicker inner foam layer which further reduces the already low interior noise level. A wind deflector is standard in the Ambiente equipment line, and head-level heating for the front seats is an option for all equipment lines. An active rollover protection system protects occupants in the event of a rollover.

The interior of the open-top four-seater features a light and clean design. The instrument panel is lean, and the center console is angled towards the driver. The three-dimensional trim strips, large round air vents and elegant control panel for the air conditioning system give a full-size-class feel to the interior.

As with every Audi, user controls in the new A3 Cabriolet are simple and intuitive; the quality workmanship sets standards. The 320 liter (*11.30 cu ft*) luggage compartment can be expanded by folding down the rear seat backs; its volume is 275 liters (*9.71 cu ft*) when the top is down.

Up to 132 kW (180 hp): three engines at launch

The new Audi A3 Cabriolet rolls off the assembly line with a choice of two TFSI engines or a TDI; all engines conform to limits of the Euro 6 emissions standard. Engine displacement is 1.4, 1.8 or 2.0 liters, and output ranges from 103 kW (140 hp) to 132 kW (180 hp). All three engines have been newly developed; they consume up to 13 percent less fuel than the engines of the previous model while delivering improved driving performance. One highlight is cylinder on demand (COD) technology in the 1.4 TFSI; it shuts down two cylinders at low load. Additional engines are in preparation.

The new Audi A3 Cabriolet also features state-of-the-art transmission technology.

The

1.8 TFSI is coupled with a seven-speed S tronic; together with the Audi drive select dynamic driving system (standard in Ambition), this lightning-fast dual-clutch transmission offers a free-wheeling function that further reduces fuel consumption. The 1.4 TFSI cylinder on demand and 2.0 TDI clean diesel transfer power to the front wheels via a manual transmission. The new quattro all-wheel drive system for the A3 Cabriolet will also be available.

The sporty character of the open-top four-seater is due, to a great extent, to its finely balanced axle load distribution – with the quattro drive system it is 56:44. This is an effect of the modular transverse matrix (MQB), upon which the Audi A3 Cabriolet is based. In the MQB, all engines have the same mounting position, and compared to the previous model, the front axle has been shifted forward by 40 mm (1.57 in).

Concentrated know-how is also evident in the car's chassis technology. Many of the components of the McPherson front suspension are made of aluminum; the four-link rear axle handles longitudinal and transverse forces separately. The power-steering system features an efficient electromechanical drive. At the limit, the electronic limited slip differential, a function of the electronic stabilization control (ESC), makes handling even more fluid and safe. Wheels range from 16 to 19 inches (the latter only in conjunction with the sport suspension or Audi magnetic ride); tires range up to 235/35 in size. A sport suspension and S line suspension are available.

As an option, the Audi A3 Cabriolet can come equipped with the Audi drive select system; it is a standard feature of the Ambition equipment line. The driver can use this system to modify engine management, power steering, S tronic and air conditioning operation over several modes. Audi drive select also incorporates multiple optional systems into its operation: Audi magnetic ride shock absorber control, adaptive cruise control, adaptive light and progressive steering, which modifies its gear ratios in response to steering input

High-end technology: MMI navigation plus

A whole modular system of infotainment components is available to customers of the open-top four-seater. At the very top are the Bang & Olufsen Sound System and MMI navigation plus. Its flat seven-inch monitor extends electrically from the instrument panel. The user terminal has a rotary/push button control and MMI touch, which together form the touchwheel – the top of which is a touch-sensitive pad for inputting letters and numbers.

The Audi connect system supplements MMI navigation plus. It connects the new Audi A3 Cabriolet to the Internet via the fast LTE transmission standard, which enables download speeds of up to 150 Mbit per second. The integrated WLAN hotspot lets passengers surf and email freely. The driver can use customized Internet services ranging from navigation with Google Earth images and Google Street View to Facebook and Twitter.

The line-up of assistance systems also highlights the leading role of the new A3 Cabriolet. The driver information system with rest recommendation is standard in the Ambition and Ambiente lines. Options include adaptive cruise control, Audi side assist, Audi active lane assist, camera-based traffic sign recognition, park assist with selective display and the Audi pre sense safety system.

Audi offers the new A3 Cabriolet in three equipment lines. The base line is called Attraction; the Ambition and Ambiente lines will appeal to customers who like an especially sporty or comfortable car, respectively. The interior colors are also adapted to the equipment lines. Customers can choose from fabric, leather and Alcantara upholstery options, and in some cases they may also be combined. The Audi design selection lasso brown conveys an exclusive look. Many of the options come directly from the full-size class, such as the convenience key.

In Germany, the new Audi A3 Cabriolet, which comes off the assembly line at the plant in Győr, Hungary, will be delivered to customers from the beginning of 2014. The price for the 1.4 TFSI with 92 kW (125 hp), which will follow a little later, is €30,500, while the 1.4 TFSI with 103 kW (140 hp) is available at a price of €31,700.

The Audi S8

The S8 is the most powerful and sportiest model in the new A8 model series. Its 4.0 TFSI engine develops 382 kW (520 hp) and delivers 650 Nm (*479.42 lb-ft*) of torque to the crankshaft between 1,700 and 5,500 rpm. The sprint from zero to 100 km/h (*62.14 mph*) takes just 4.1 seconds; top speed is a governed 250 km/h (*155.34 mph*). The sonorous V8 biturbo consumes on average 9.6 liters of fuel per 100 kilometers (*24.50 US mpg*), a CO₂ equivalent of 225 grams per km (*362.10 g/mile*).

Behind these top figures is the entire range of Audi's technological expertise – from the layout of the cylinder heads, whose hot side is on the inside, to the twin-scroll turbochargers to the cylinder on demand (COD) system, which shuts down four of the eight cylinders when operating under part load. The Active Noise Cancellation (ANC) system and the active engine mounts suppress undesired noise components and vibrations during these phases by producing precise antiphase vibrations.

The eight-speed tiptronic in the S8, which can be controlled via the elegant selector lever or electronically via paddles on the steering wheel, also combines sportiness and efficiency. It keeps engine speed low, yet kicks down quickly and comfortably when prompted by the driver. The automatic transmissions directs the power to the quattro permanent all-wheel drive system, which includes a sport differential on the rear axle. This distributes the torque between the wheels as needed for even more agile handling.

Chassis

The Audi S8 owes its dynamic character in large part to the chassis. Axle load distribution is balanced, and all wheel control arms are aluminum. The Audi drive select system, which enables the driver to influence the function of various technical modules, is standard. It also controls the adaptive air suspension sport, including active damping.

Another standard feature in the Audi S8 is the dynamic steering, which varies its ratio as a function of speed. It is direct at low speeds and indirect at high speeds. It uses an electromechanical drive that reduces fuel consumption and also enables the use of new assistance systems. Like the sport differential and the adaptive air suspension sport, the dynamic steering also features S-specific tuning.

The new Audi S8 comes standard with 9 J x 20 wheels shod with 265/40-series tires. Options range up to exclusive 21-inch wheels with 275/35-series tires. The internally vented disc brakes have a diameter of 400 millimeters (*15.75 in*) up front and 365 (*14.37 in*) in the back. S8 logos adorn the black, six-piston calipers up front. Audi also mounts optional carbon fiber ceramic discs with anthracite gray brake calipers.

Body

Audi, the leading brand in automotive lightweight construction, has given the S8 a body made entirely of aluminum with the exception of the B-pillars. Designed as an aluminum Audi Space Frame (ASF), it weighs just 231 kilograms (*509.27 lb*), roughly 40 percent less than a comparable steel construction. The ASF body enables further weight savings in numerous other areas of technology.

Besides passive safety, acoustics were another key focal point during the development of the chassis. Sophisticated insulating measures minimize the noise level in the cabin. The trunk now has a maximum capacity of 520 liters (*18.36 cu ft*), and a new layout makes it very easy to load.

Exterior design

Length (5.15 meters [*16.90 ft*]), wheelbase (2.99 meters [*9.81 ft*]), width (1.95 meters [*6.40 ft*]) and height (1.46 meters [*4.79 ft*]) give the Audi S8 the sportiest look in the segment. Striking design details demonstrate its character. Its Singleframe grille is painted platinum gray, and the horizontal double bars are finished in chrome. The two large air inlets on the outside are filled with honeycomb grilles and structured with thick chrome bars. The lower section of the front apron is a splitter shifted to the front. Audi offers optional headlights featuring Matrix LED technology. In this case, the high beam is broken up into 25 individual segments per headlight.

On the flanks, body color trim strips on the sills and polished aluminum-look mirror housings catch the eye. The diffuser insert at the back is platinum gray and includes a two-layer blade in an aluminum-look finish. The exhaust system ends in twin oval tailpipes on each side of the car. S8 or V8 T badges can be found in the front, on the back and on the sides. The finish Daytona Gray, pearl effect is reserved exclusively for the sporty top-of-the-line model.

Interior

The interior of the large sports sedan enchants with its elegant, airy lines. The instrument panel is lean and low, and below the windshield is a long arc - the wrap-around. Space is generous in every seat. The front seats are available with ventilation and a massage function featuring five programs and intensities. Individual, power-adjustable rear seats are available as an option.

The grey dials of the instruments and white needles are characteristic of Audi S-model interiors. The inlays are Carbon Atlas and brushed aluminum, the door trim panels are Alcantara and the tiptronic selector lever is CFRP. The pedals and footrest shine in stainless steel. A red ring adorns the start-stop button; an S8 badge the steering wheel. The door sill trims feature lighted S8 badges. There is a choice of four colors for the interior and ten colors for the upholstery.

The standard comfort sport seats are covered in perforated Valcona leather and feature diamond-quilted center sections. An exclusive option for the S8 is the Audi design selection vermont brown. The inlays here are called Carbon twill copper – a copper thread matching the color of the seat coverings runs through the CFRP fabric.

All of the materials in the new Audi S8 have been carefully chosen and precisely worked. Lovingly executed details document the hand-built character, from the barely visible gaps in the two-piece inlays to the ambient lighting with its adjustable LED light to the seat covers in premium grades of leather. The Audi exclusive program offers additional customization options for particularly discerning customers.

Equipment and trim

In keeping with its sporty character, the new Audi S8 comes with a generous range of standard equipment. Examples include MMI navigation plus and the Audi connect hardware including car phone, which connects the sedan to the Internet. Audi offers the Bang & Olufsen Advanced Sound System and Rear Seat Entertainment as options.

MMI navigation plus is closely networked with additional systems on board the S8, including the optional adaptive cruise control with stop&go function. The radar-based cruise control itself is linked to an expanded version of the standard Audi pre sense basic safety system, as is another optional system, Audi side assist. The camera-based speed limit display is also available. New in the Audi S8 are Audi active lane assist and the park assist with 360° display. The head-up display projects important information onto the windshield. The night vision assistant now recognizes larger animals in addition to pedestrians.

Other standard equipment in the new Audi S8 includes double/acoustic glazing, LED headlights, the convenience key with sensor-controlled trunk lock, a DVD changer, four-zone automatic air conditioning and the Bose Surround Sound System. Options include such features as privacy glazing, a cool box, fold-out tables and an ionizer for improved air quality.