

# RAV4 Technology: Smartest SUV On the Block

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From new multimedia technology to smarter all-wheel drive and a more efficient hybrid powertrain, the fifth-generation Toyota RAV4 is brimming with high-tech that works seamlessly and conveniently to deliver a rewarding driving and ownership experience.

The technology show starts when you step into the RAV4. On Adventure, Limited and XSE grades, the 7-inch TFT speedometer can be switched between analog and digital displays, letting the driver set the mood. The Multi-Information Display (MID) is upgraded to 7.0-inches, versus 4.2-inches in lower grades.

Through new multimedia technology, RAV4 connects with its driver's lifestyle as never before. Every 2019 RAV4 model is equipped with Amazon Alexa and Google Assistant capability and Entune 3.0 Audio, a comprehensive system that includes 6 speakers, 7.0-in. touchscreen, AM/FM, Scout GPS Link Compatible with up to 3-year trial, Siri Eyes Free, Apple CarPlay Compatible, aux. port, USB media port (plus four additional USB charging ports on XLE and above), hands-free phone capability, advanced voice recognition and music streaming via Bluetooth. Toyota Connected Services include Safety Connect with 3-year trial and Wi-Fi Connect Powered by Verizon with up to 2GB within a 6-month trial.

The XLE grade can be upgraded with Entune 3.0 Audio Plus, which adds an 8-inch touchscreen and SiriusXM Radio, plus Toyota Connected Services/Service Connect with a complementary 3-year trial.

Entune 3.0 Premium Audio with Dynamic Navigation is available for the Adventure and Limited grades, also using an 8-inch touchscreen, Dynamic Navigation with up to a 3-year complementary trial, Dynamic POI Search and Dynamic voice recognition. It can be packaged with the JBL with Clari-Fi audio system, which rocks music of all genres through 11 speakers in nine locations at 800 watts. This knockout audio system features:

- A-pillar horn tweeters located for optimal high-frequency performance
- Next-generation HiD8 Amplifier
- Wide-dispersion instrument panel speakers providing greater sound and alert functionality
- Wide-dispersion front door speakers enhancing sound quality for front passengers
- Full range rear door speakers enhancing sound quality for rear passengers
- Ported subwoofer in rear cargo area with a more powerful deep-bass response
- Clari-Fi technology that intelligently adjusts to every audio format to match source quality with the precise level of audio restoration necessary

Optional Technology Packages vary by grade, adding Intelligent Clearance Sonar with Rear Cross-Traffic Braking on the XLE, and then also expanding to the new Digital Rearview Mirror and Qi-compatible wireless smartphone charging on higher grades.

For the Limited grade, which already has some of those features, the available Advanced Technology Package includes the Smart Key System on all doors and height-adjustable, foot-activated power liftgate with jam protection, Bird's Eye View Camera with Perimeter Scan, Overhead 360-degree view in drive and reverse, and curb view, plus Qi-compatible wireless charging.

### **Smarter All-Wheel Drive**

All-wheel drive (AWD) may have become a ubiquitous term in the automotive industry, especially among SUVs, but not all AWD systems are the same. Toyota took a smarter approach to a technology that many might not even think about. The result is additional effective traction for inclement and slippery weather and trails, while reducing AWD's typical drag on fuel economy.

The 2019 RAV4 offers three different AWD systems. In LE and XLE models, the optional AWD can send up to 50 percent of available torque to the rear wheels when necessary.

Standard on AWD-equipped Limited gas and Adventure grade models, Dynamic Torque Vectoring is added to the AWD system, which uses special couplings to manage torque distribution between the left and right rear wheels. As a result, should one rear wheel lose contact with the surface – during trail driving, for example – torque will flow to the grounded wheel to help keep the vehicle moving. In driving situations where AWD is not needed, Rear Driveline Disconnect uses a ratchet-type dog clutch to disengage the rear wheels and stop the rear drive shaft's rotation. That reduces the energy needed to propel the vehicle, therefore helping to reduce fuel consumption.

### **Why Wait for Slip?**

The RAV4 AWD system does not simply react to wheel slippage. Rather, the sophisticated AWD Integrated Management (AIM) integrates control of the engine, transmission, Electric Power Steering (EPS), AWD system, and brakes, changing its logic according to the driving environment.

During on-road driving, the system manages steering assist, throttle control, shift control and drive force distribution to further enhance steering stability. In off-road driving situations, the system adds brake control to the mix.

Standard on AWD-equipped gas RAV4 models, Multi-Terrain Select gives drivers the ability to maximize traction when driving through mud, sand, rocks or dirt. The system is easy to use thanks to control buttons or a control dial (depending on the grade) positioned to the left of the transmission shift lever.

The driver can select Mud & Sand mode for beach driving, or Rock & Dirt mode for trails. Using the Multi-Information Display (MID), the driver can view torque allocation and slip control, which will fluctuate depending on driving and road conditions.

### **Toyota Safety Sense 2.0**

Toyota has fulfilled a goal to make driver safety systems with automatic emergency braking standard on most models, and the 2019 RAV4 debuts with the second generation of the Toyota Safety Sense system (TSS 2.0). The full system is standard on all grades and includes:

#### **Pre-Collision System with Pedestrian Detection (PCS w/PD)**

Capability to detect a preceding vehicle or pedestrian in daytime or with better low-light recognition capabilities, or daytime bicyclist (new). System will alert the driver with audible and visual warnings and/or apply brakes to help mitigate or avoid the collision in certain cases (using Forward Collision Warning (FCW), Brake Assist (BA), and Automatic Emergency Braking (AEB)).

#### **Full-Speed Range Dynamic Radar Cruise Control (DRCC)**

For highways/freeways only, this adaptive cruise control functions at 0-110 mph and enables low-speed speed matching, stopping, and acceleration/deceleration relative to a preceding vehicle traveling at a slower speed. Speed, cut-in, and distance control are enhanced, as well as Turn Signal Linked control added, for a more natural response.

#### **Lane Departure Alert with Steering Assist (LDA w/SA)**

Newly added to LDA w/SA is the capability, under some circumstances, to detect the road's edge, in addition to

the pre-existing capability to detect visible lane markers and the vehicle's position in the lane. If unintentional lane deviation is detected, the system alerts the driver with audible and visual warnings. Steering Assist can provide small corrective steering inputs to help the driver prevent the vehicle from unintentionally leaving its lane.

### Automatic High Beam (AHB)

Capability to automatically activate and deactivate high beams based on the driving environment and preceding vehicle's lights.

### New Lane Tracing Assist (LTA)

For highways/freeways only, LTA can be enabled when using DRCC and has the capability to recognize white or yellow lane markings or the path of a preceding vehicle if lane markers are temporarily unavailable. It can also identify and actively track the center of the lane by providing steering assistance (hands-on, driver-assist system). This reduces driver burden and helps support safe driving, especially in traffic congestion on long highway trips. The LTA system can be turned on/off.

### New Road Sign Assist (RSA)

Capability to identify certain Stop, Yield, Do Not Enter and speed limit signs and signal driver with visual and audible alerts. The alerts vary based on sign type and are shown on the Multi-Information Display (MID).

### **Smarter Hybrid**

Since introducing the first mass-production gas/electric hybrid vehicle, the Prius, 22 years ago, Toyota has continually refined and upgraded the technology. The new-generation Toyota Hybrid system in the RAV4 HV is more compact, more efficient and quieter than in the previous model.

Big changes in the geartrain yield significant efficiency improvements. The new transaxle mounts the electric motors (MG1 and MG2) coaxially rather than in-line, and the resulting smaller and lighter package reduces frictional losses.

The reduction gear is now a parallel shaft gear, rather than a planetary, and a new multi-function gear integrates the power-split planetary ring gear, parking gear, and counter-drive gear. The changes add up to an approximately 25-percent reduction in transmission losses compared to the previous model. ?

Further efficiency improvements come from a variable cooling system (electric water pump, electric thermostat) and a fully variable oil pump.

Energy transmission losses are reduced by new computer integration and a smaller, lighter power stack installed directly above the transaxle.

The new Ni-MH battery pack is smaller and more efficient than in the previous RAV4 HV, reducing HV battery charging time and frequency and contributing to enhanced fuel efficiency. The pack is small enough to be installed under the rear seats, rather than taking up space under the cargo area.

### **Hybrids Have Fun, Too.**

The RAV4 HV driver will notice a more linear acceleration feel, thanks to the way the system optimizes the level of electric motor assistance and engine rpm without the engine running at high revs. Engine speed is synchronized with vehicle speed. Differential pre-load yields better standing-start performance and straight-line stability.

Sport mode optimizes drive torque to prioritize acceleration performance, making RAV4 HV feel more responsive. A sequential shifting feature delivers responsive engine braking force in steps, like a manual transmission. The driver can “downshift” the vehicle for more engine braking using auto-manual shifting or the “S” position on the shift lever.

The 2019 RAV4 HV can even coach the driver toward achieving higher fuel economy. An accelerator guide function suggests an acceleration amount to the driver according to the driving conditions, and a scoring function adds a measure of fun to eco driving.

### **Predictive Efficient Drive**

What if a vehicle could teach itself to operate more efficiently? That’s the concept behind the RAV4 HV’s Predictive Efficient Drive. With navigation system operation, it analyzes driving habits and the expected road and traffic conditions to optimize hybrid battery charging and discharging. The more the RAV4 Hybrid is driven, the more data is gathered to help optimize fuel consumption. (The system can be turned off.)

Predictive Deceleration Support technology uses accumulated knowledge about a driver’s behavior to predict when and where the vehicle is likely to slow down or stop, reducing energy consumption through optimum accelerator pedal release timing guidance. The system can predict deceleration behavior up to approximately two-tenths of a mile ahead of the target zone. ?

Predictive State of Charge (SOC) predicts if there are any downhill roads or traffic jams ahead while the navigation system is providing route guidance, contributing to improved actual fuel efficiency by increasing the hybrid battery charging when appropriate. For example, it could draw more from the battery before a downhill section, thereby maximizing the benefit of regeneration on the downhill section. If traffic congestion is shown to be ahead, the system will actively charge the battery beforehand, so that the vehicle can rely more on battery power when it reaches that congestion.