

S-AWC for New Outlander PHEV

Super All Wheel Control evolution by Electrification

Dec. 2022

Engineering Fellow

Kaoru SAWASE, Ph.D.

Agenda

01

S-AWC history and benefit

02

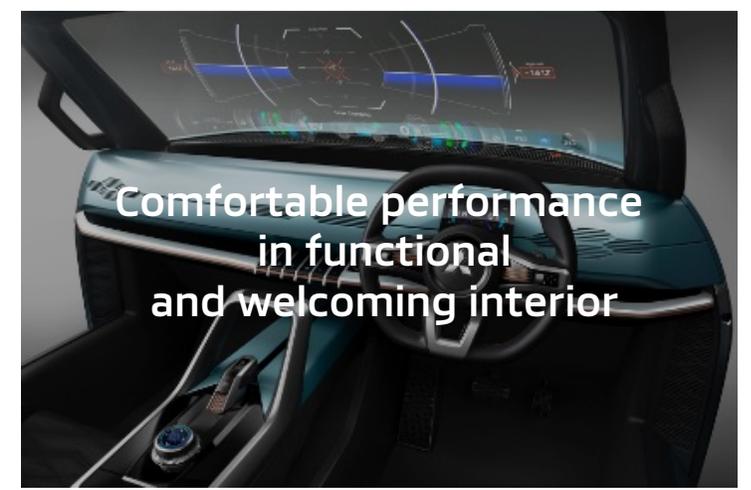
S-AWC evolution by Electrification

03

S-AWC evolution with Drive Mode



Vision of Mitsubishi Motors



✓ **S-AWC enhances not only Safety, but also Security and Comfort**

~Common Protective technologies~

~Safety~

- Compensation for driving error
(Active safety technology)
- Collision safety vehicle
(Passive safety technology)

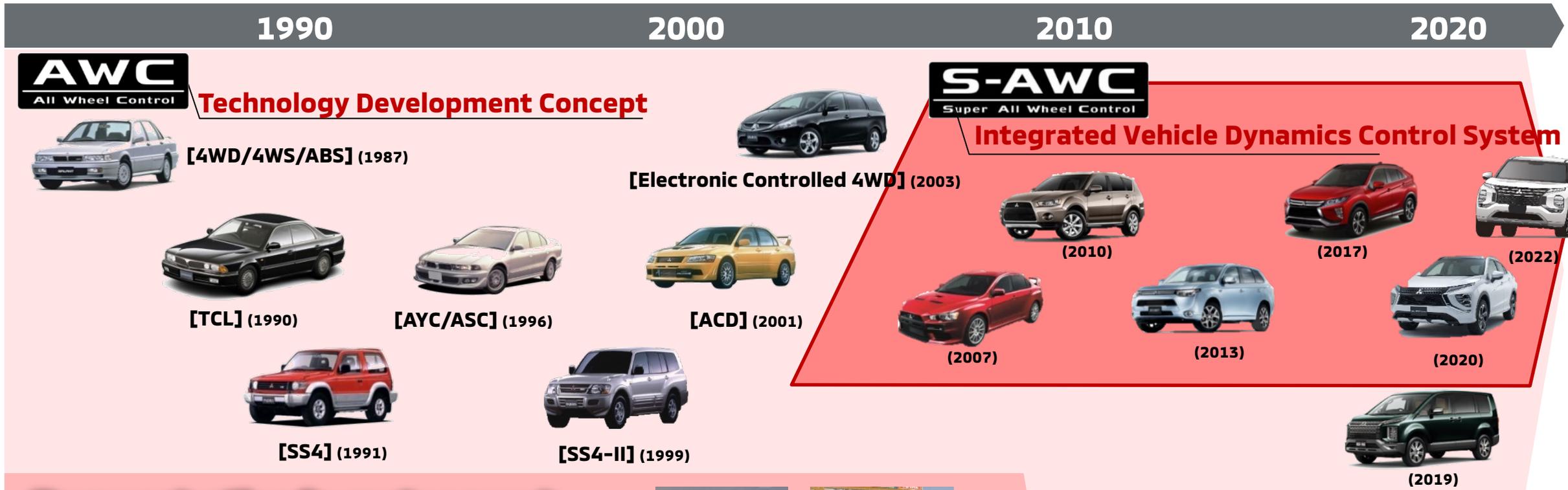
~ S-AWC ~

~Security & Comfort~

- Precise driving characteristic reduces driving error
- Smooth driving makes all passengers comfortable
(Basic DP technology + S-AWC)

S-AWC history

✓ Technology born from years of global motorsport success



Demonstration in motor sport

Dakar Rally (1983~2009)



1992-3, 1997-8, 2001-7 12 Overall Victories

WRC (1974~2005)

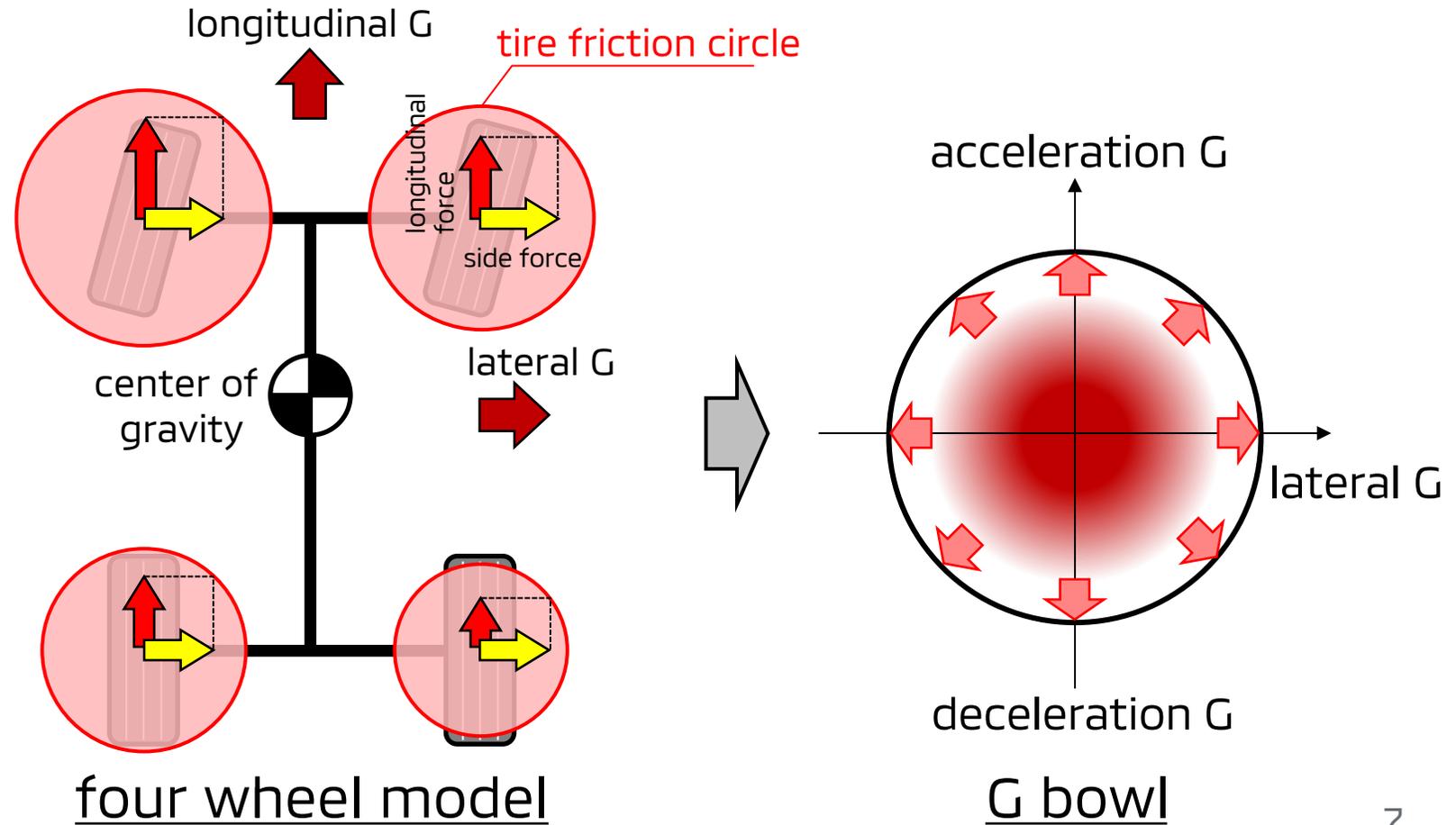


1996-9 Drivers Champion, 1998 Manufacturers Champion

AWC : Technology Development Concept

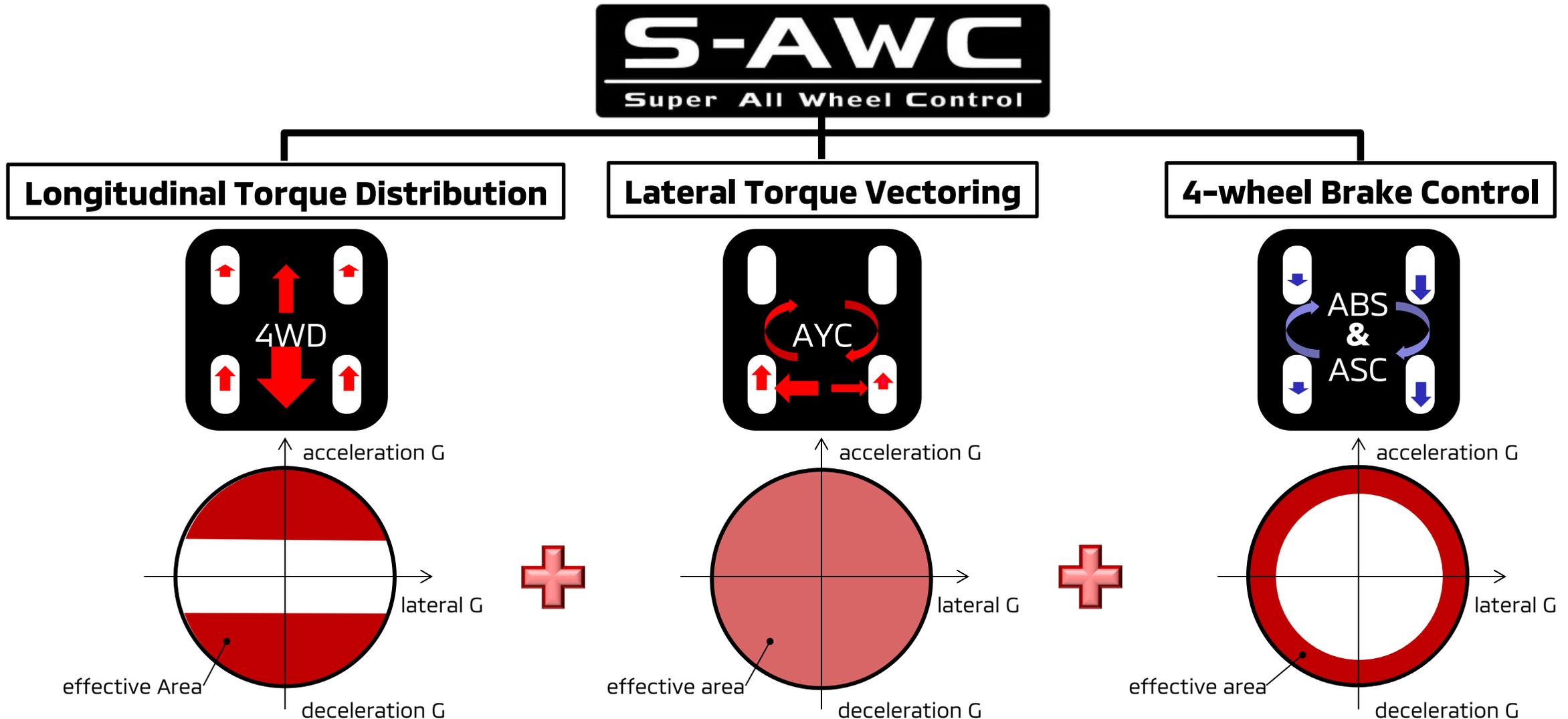


✓ To provide **“Driving pleasure”** and **“Toughness & Safety”** by making the best use of four tire friction forces (since 1987)



S-AWC : Integrated Vehicle Dynamics Control System

- ✓ S-AWC controls the driving/braking force of all four wheels to improve the vehicle dynamics

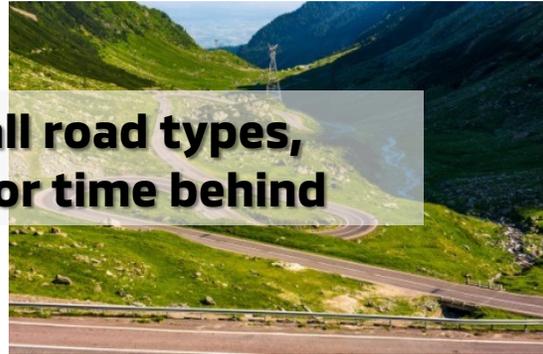


S-AWC vehicle dynamics performance

✓ **Delivering confidence regardless of road or conditions**



➤ **System tuned for all road types, surfaces, weather or time behind the wheel**



➤ **Transparent operation ensures passenger ease and comfort**



Traction
performance



Traction maximized for all conditions, including steep slopes or submerged roads



Stability
performance



Reduces fatigue in cross winds, on crowned roads or in adverse conditions



Handling
performance



Agile and smooth response that ensures peak performance on winding roads

User Benefit ~Traction performance~

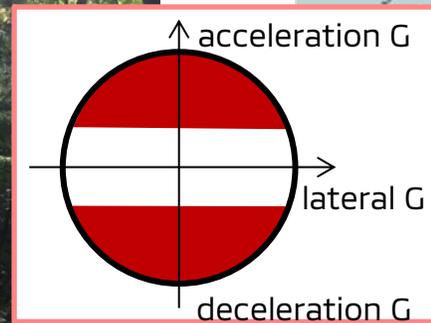
✓ With S-AWC, you can drive with confidence on steep slopes, muddy roads, snowy roads, etc.

Have you ever had such an experience?

Wheels spin on unpaved slope



Vehicle skid on snow covered road



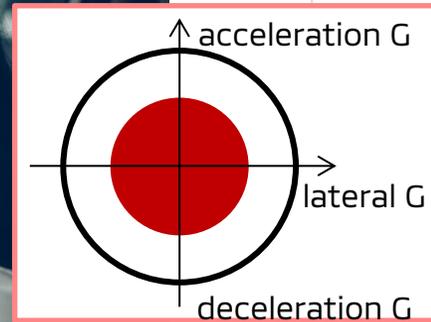
User Benefit ~Stability performance~

✓ With S-AWC, you can drive safely and comfortably while remaining alert

Have you ever had such an experience?

Fatigue caused by vehicle staggering during long-distance drives

Gust of wind on the highway pushing the vehicle off its intended course

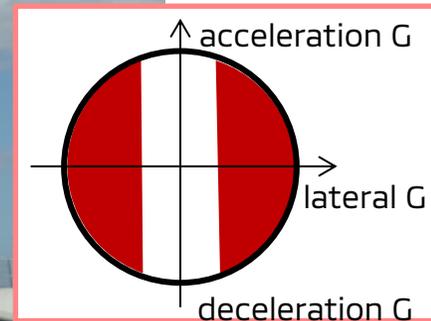


User Benefit ~Handling performance~

✓ With S-AWC, you can drive smoothly and comfortably on winding roads

Have you ever had such an experience?

Tighter curve than expected at highway junction



Passengers' motion sickness on winding roads



User Benefit Video



Agenda

01

S-AWC history and benefit

02

S-AWC evolution by Electrification

03

S-AWC evolution with Drive Mode

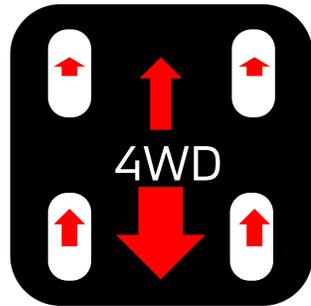


S-AWC evolution

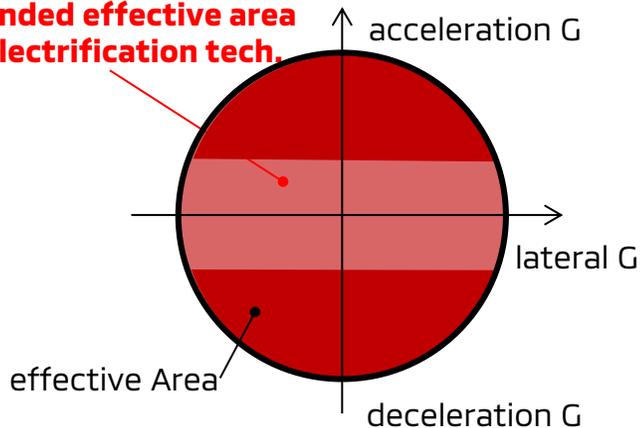
✓ Longitudinal Torque Distribution has achieved the ideal performance state through the control freedom of electrification technology

S-AWC Super All Wheel Control

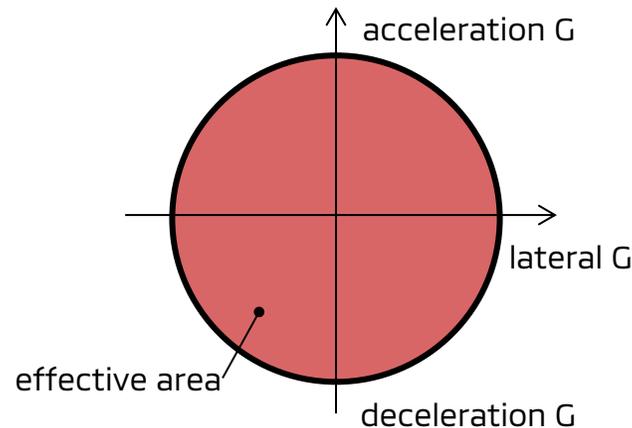
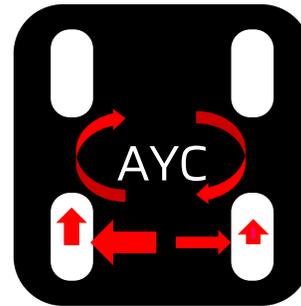
Longitudinal Torque Distribution



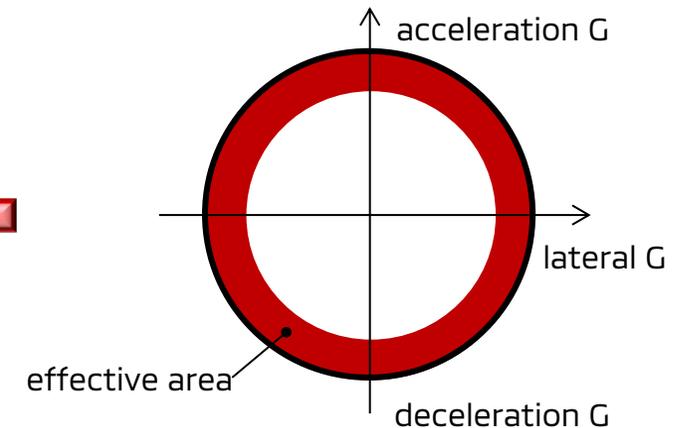
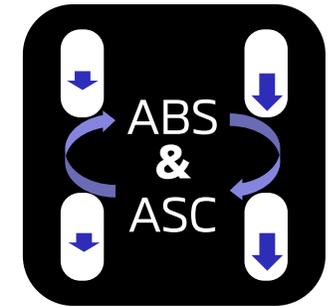
Expanded effective area by electrification tech.



Lateral Torque Vectoring



4-wheel Brake Control



Classification of Longitudinal Torque Distribution

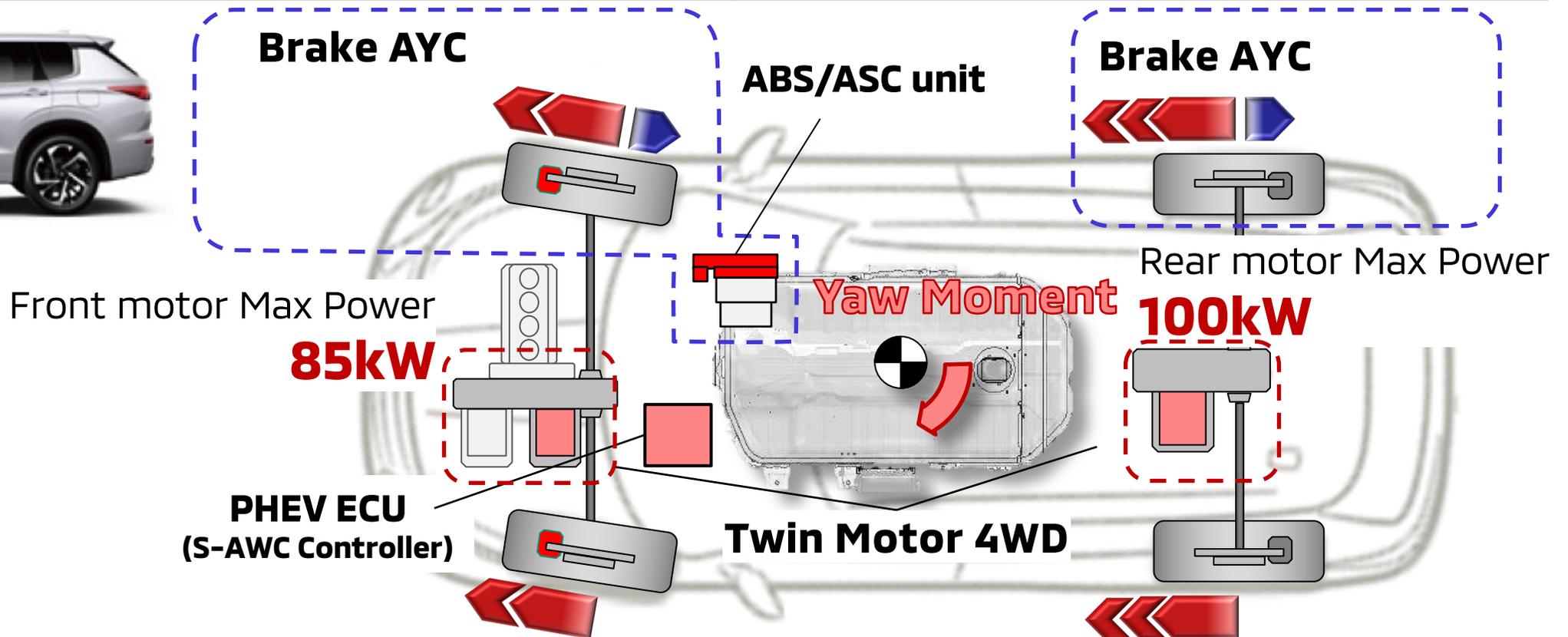
✓ **Twin e-Motor 4WD has high accuracy and high flexibility**



Device	Differential Gear	Clutch	Twin e-Motor
System Configuration			
Torque Distribution Characteristics	<p>rear wheel torque</p> <p>front wheel torque</p> <p>fixed distribution by design phase</p>	<p>< In case of FWD vehicle base ></p> <p>rear wheel torque</p> <p>front wheel torque</p> <p>limit by clutch torque</p> <p>during only FW speed > RW speed</p>	<p>rear wheel torque</p> <p>front wheel torque</p> <p>flexible distribution</p>

S-AWC of Latest Outlander PHEV

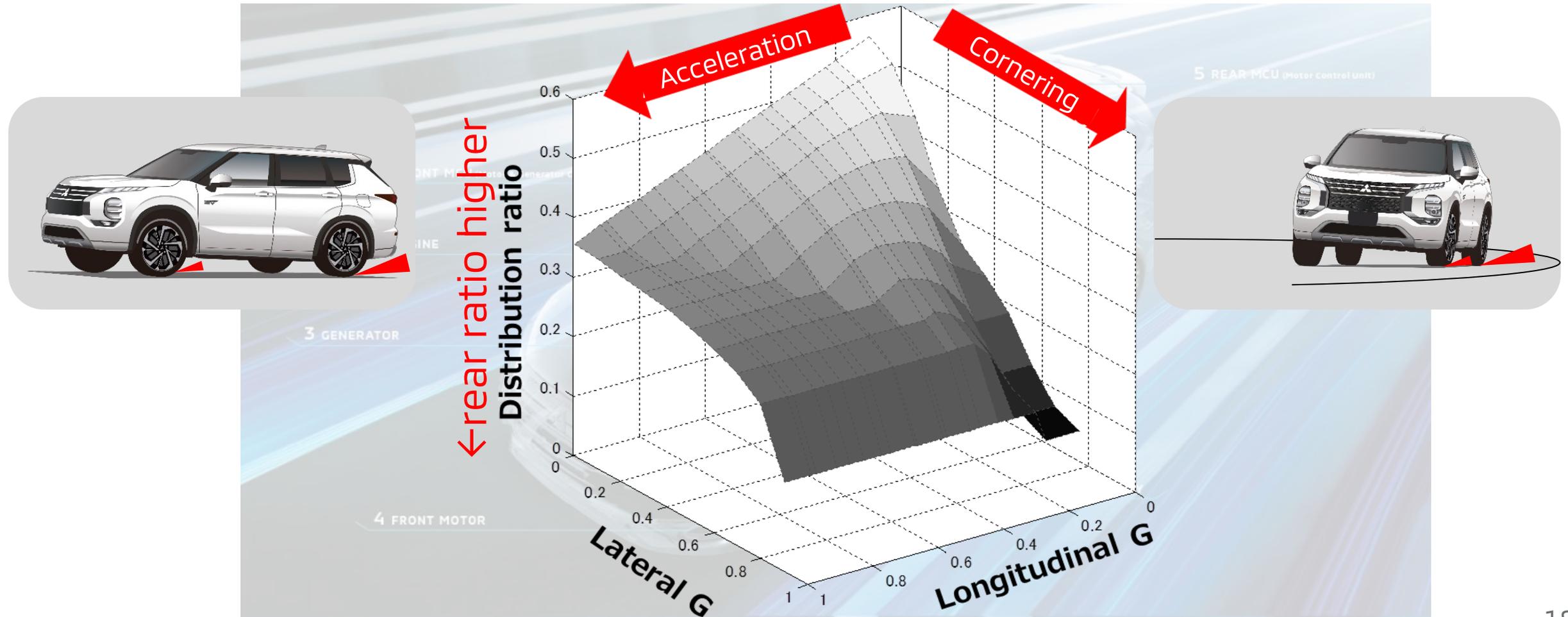
✓ **Twin Motor 4WD design features a more powerful rear motor than front, providing traction, stability, and handling confidence**



- ┌ Longitudinal Torque Distribution
 - ├ Lateral Torque Vectoring
 - └ 4-wheel Brake Control
- ┌ Twin Motor 4WD
 - ├ Brake AYC
 - └ ABS & ASC

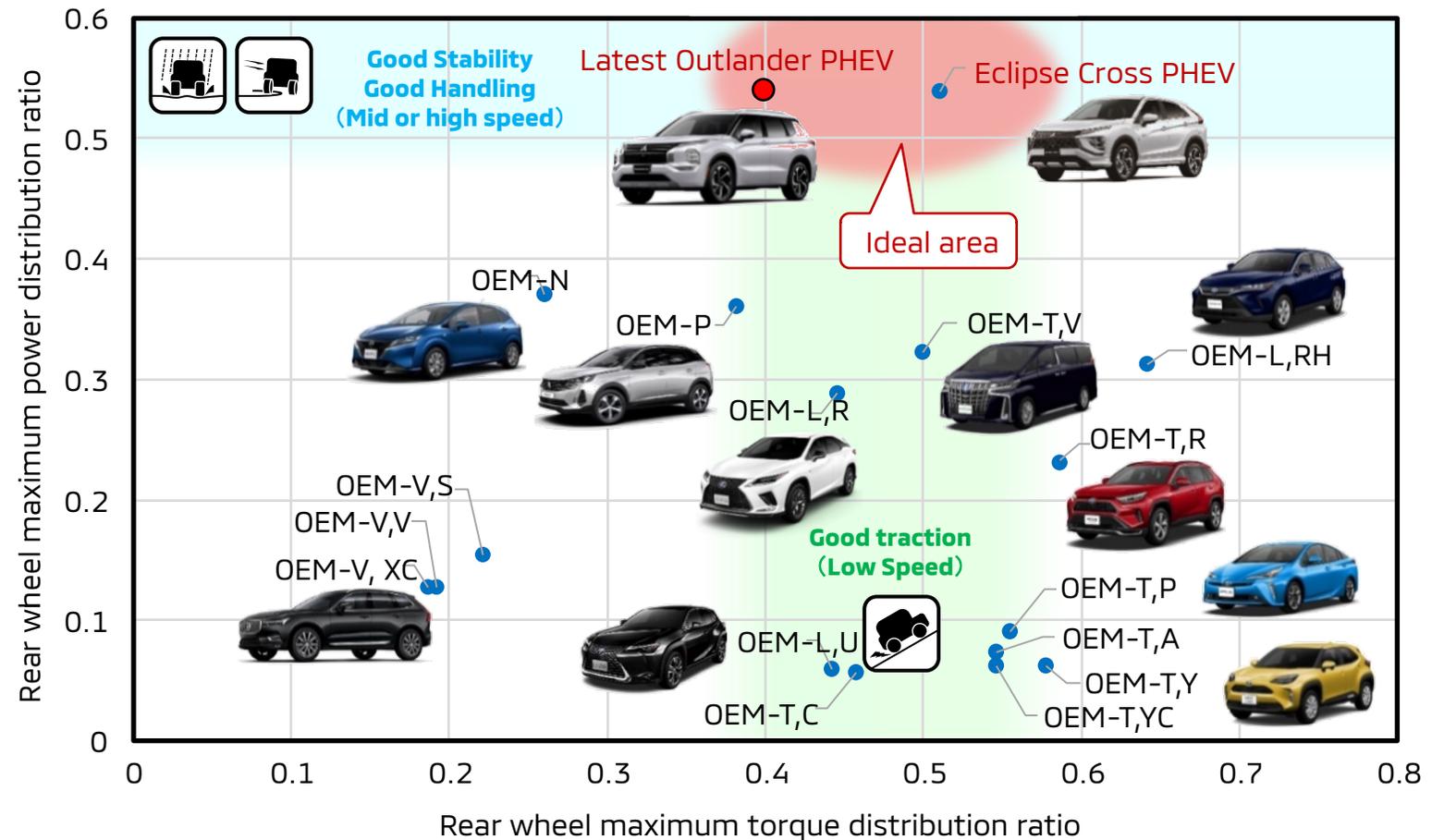
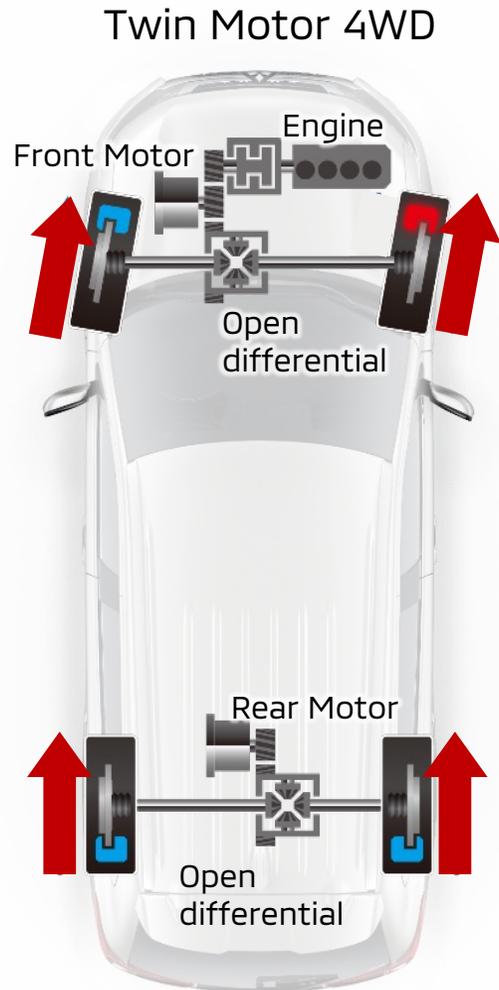
Ideal Longitudinal Torque Distribution Control

- ✓ **Twin Motor 4WD provides the ideal longitudinal torque distribution control and delivers safety/security/comfort in all conditions**



Twin Motor 4WD benchmark

✓ **Bigger rear motor max power and torque than front provides the ideal longitudinal torque distribution**

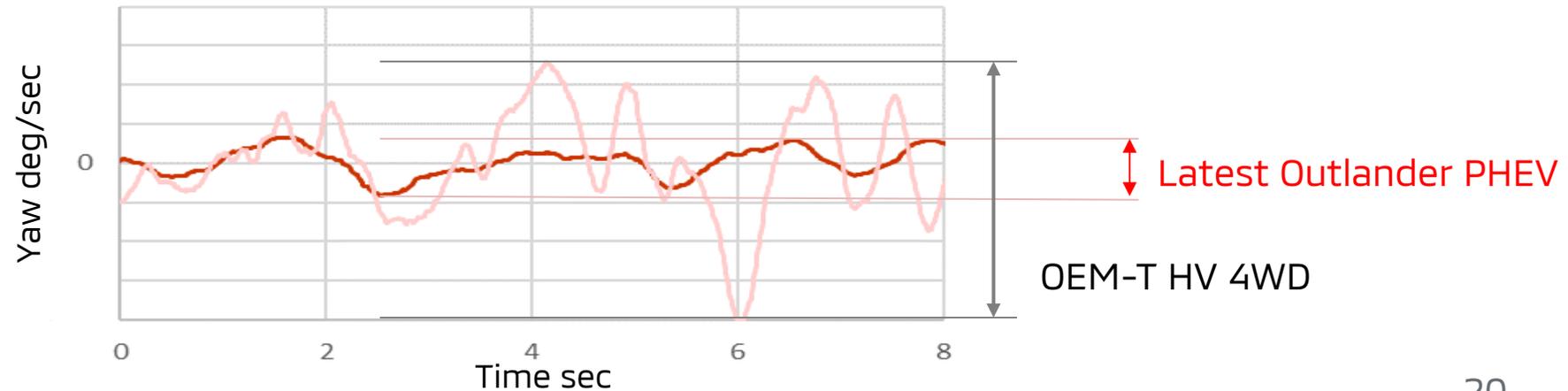
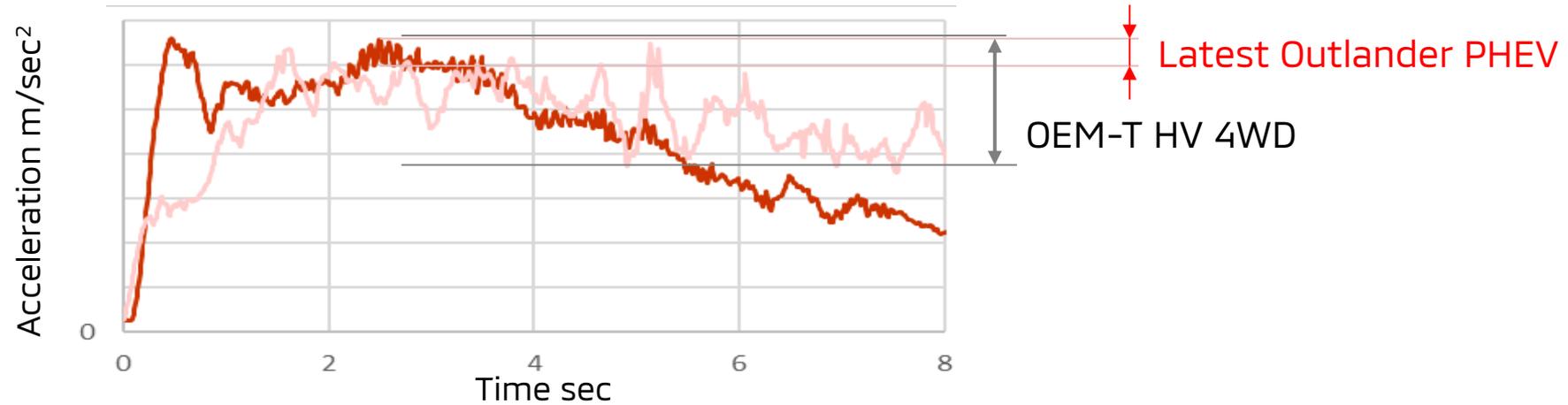
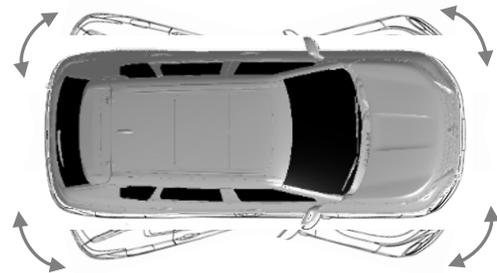


Longitudinal driving force distribution characteristics of electric 4WD vehicles

Benchmarking ~Traction • Stability~

✓ Achieve powerful, smooth and stable acceleration

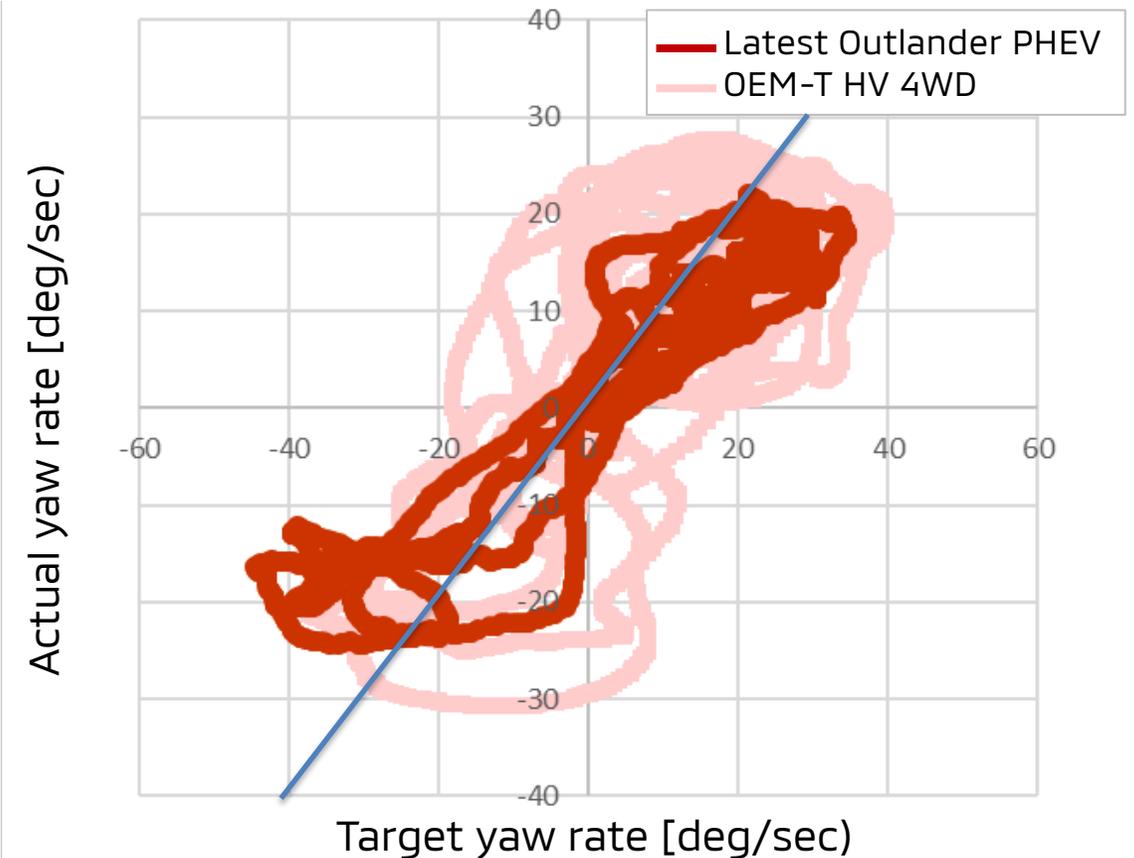
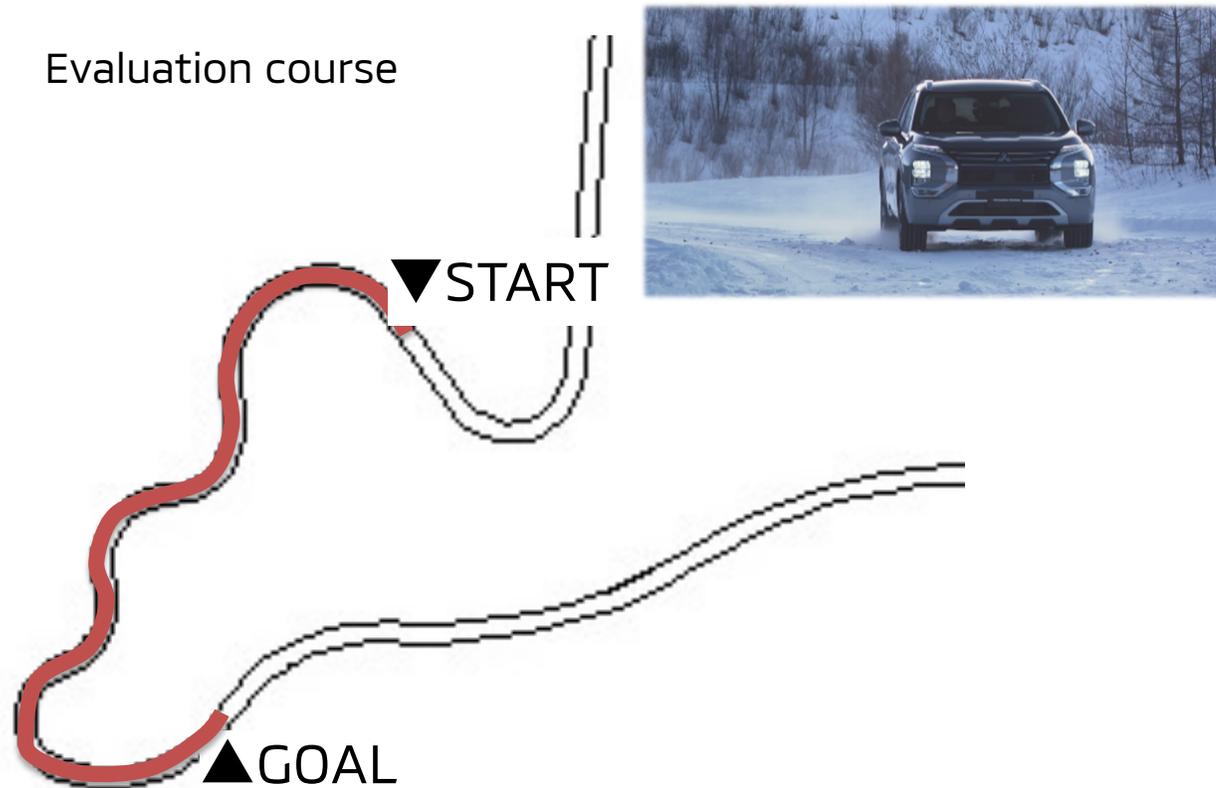
WOT acceleration from 30km/h on snow-packed road



Benchmarking ~Handling~

✓ **Achieve smooth and confident driving with good steering linearity**

Normal speed driving when driving on a snow-packed handling course



Future of S-AWC with Electrification



Future

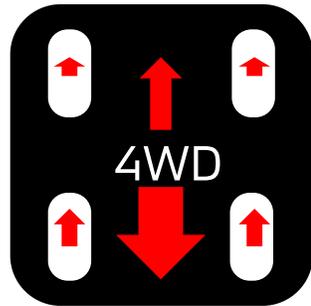
Evolution forward Fusion

S-AWC evolution Next Stage

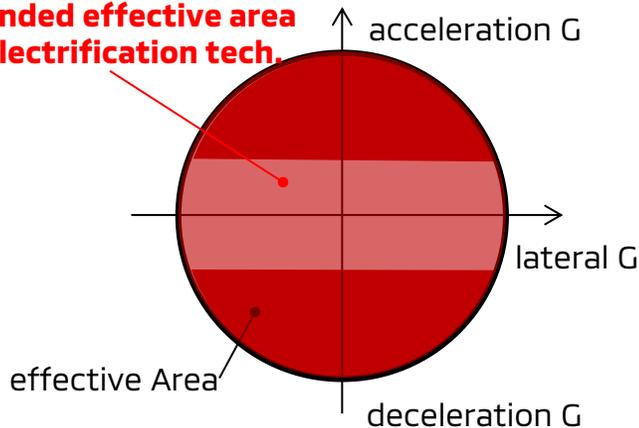
✓ Electrification technology provides tuning freedom to allow Lateral Torque Vectoring to deliver response and accuracy, becoming the ideal performance state

S-AWC Super All Wheel Control

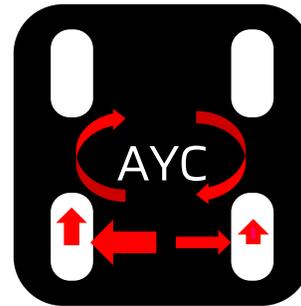
Longitudinal Torque Distribution



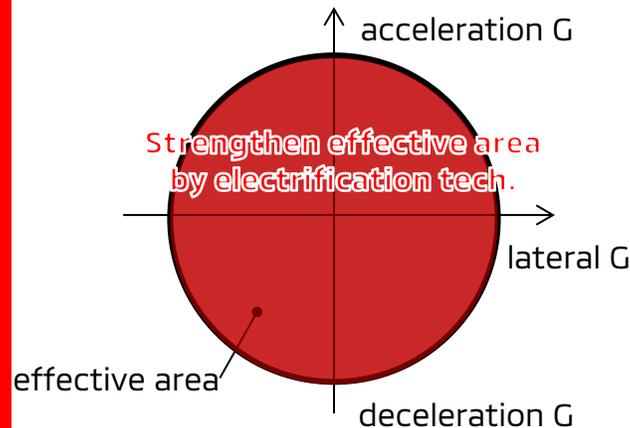
Expanded effective area by electrification tech.



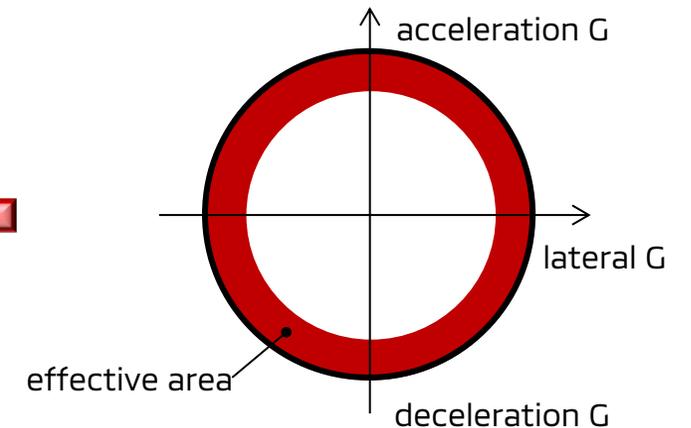
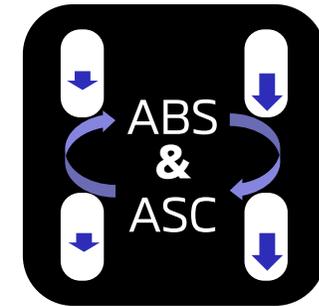
Lateral Torque Vectoring



Strengthen effective area by electrification tech.



4-wheel Brake Control



Classification of Lateral Torque Vectoring

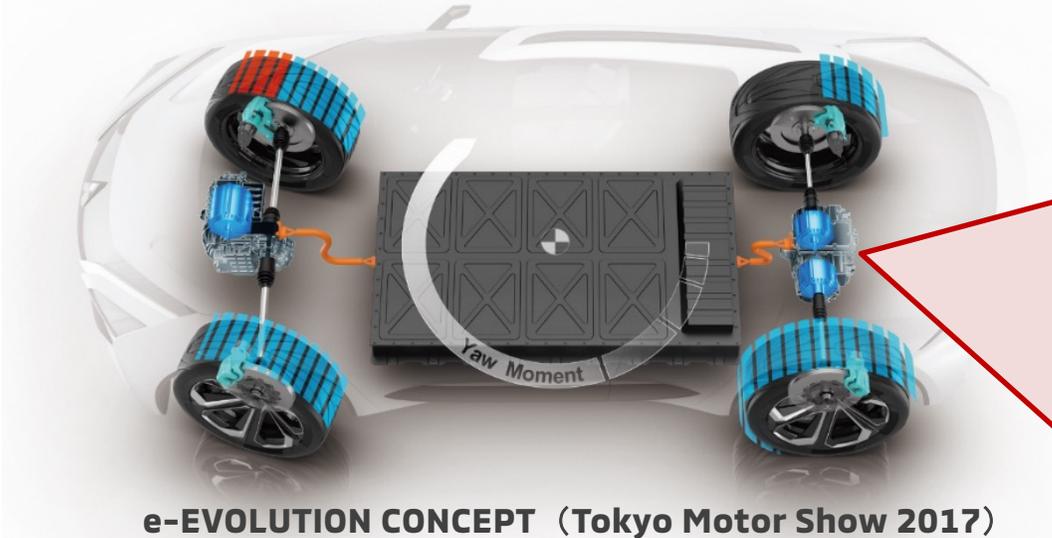
✓ **Dual Motor AYC has ideal effective area to improve vehicle dynamics**



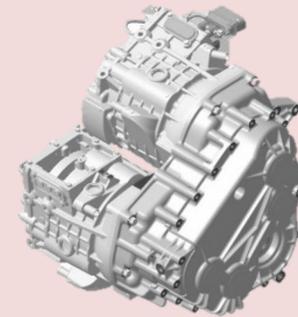
Device	Twin Clutch	Brake AYC	Independent e-Drive	Dual Motor AYC
System Configuration				
Torque Vectoring Characteristics				

S-AWC of Triple Motor 4WD with Dual Motor AYC

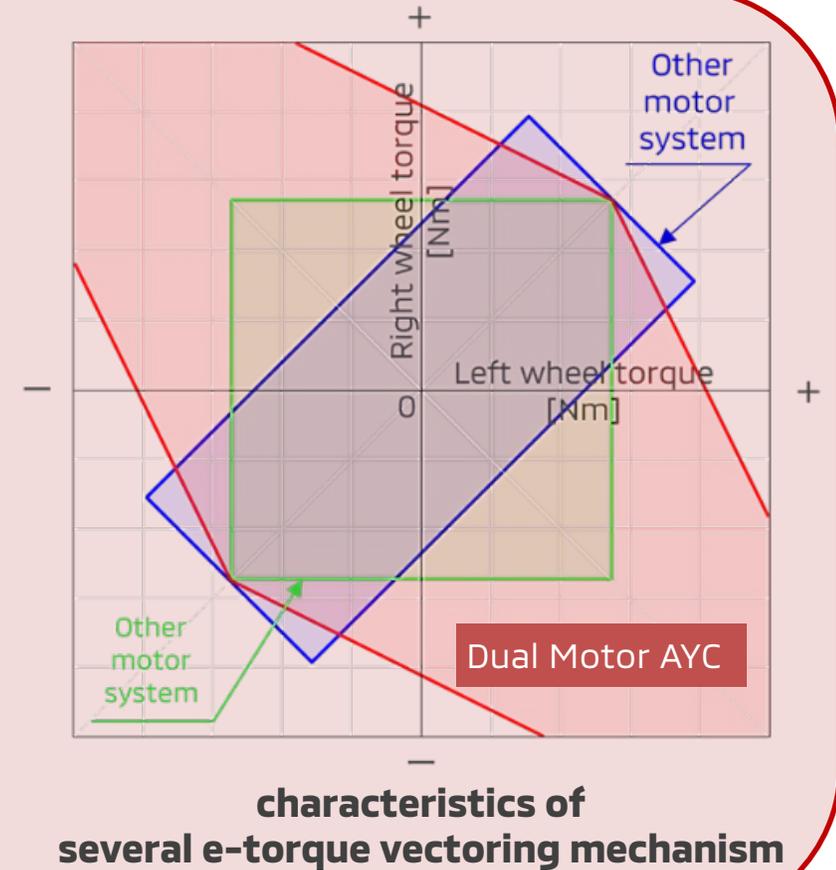
- ✓ **Delivers complete confidence with the high response, accuracy and flexibility of electrification technology**



Triple Motor 4WD first pilot model



**Dual Motor AYC
prototype**



Benchmarking Triple Motor 4WD

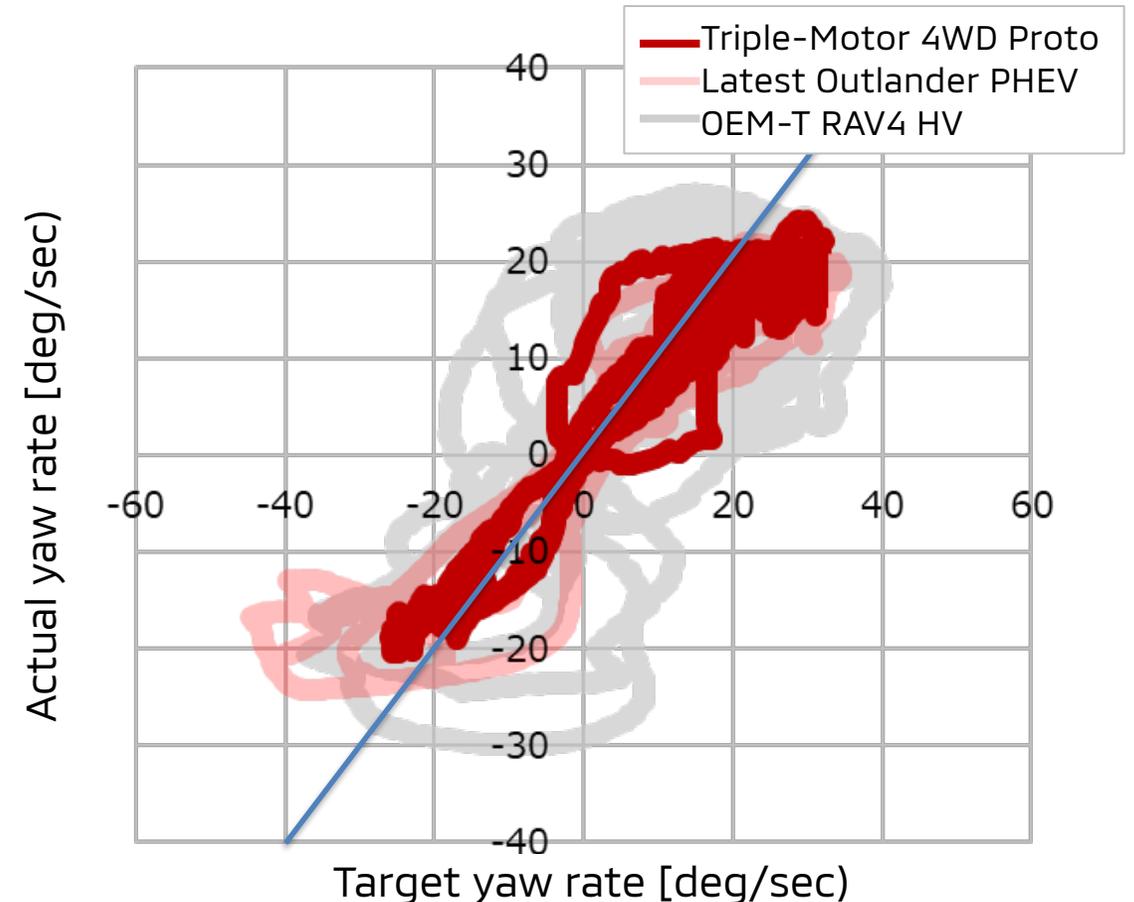
✓ Achieve more smooth and confident driving with good steering linearity

Amount of grip delivered when driving on a snow-packed handling course

Evaluation course



*Triple-Motor 4WD Proto
(base : Outlander PHEV old model)*



Agenda



01

S-AWC history and benefit

02

S-AWC evolution by Electrification

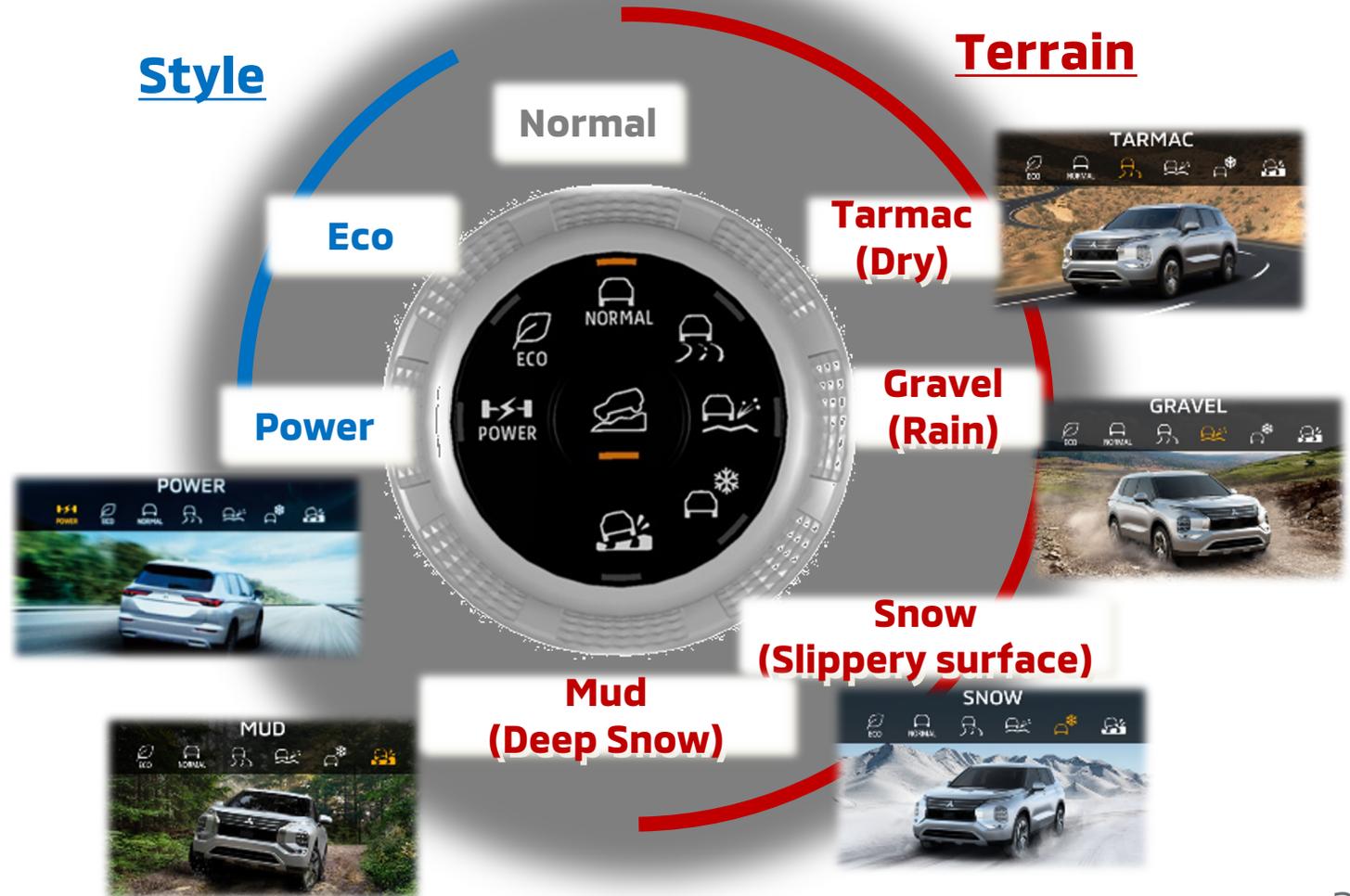
03

S-AWC evolution with Drive Mode



Drive Mode Selector of Latest Outlander PHEV

✓ S-AWC(4WD, AYC, ASC, TCL), Powertrain and Steering by 7 modes



Drive Mode Selector of Latest Outlander PHEV

✓ Best tuning for several driving styles and scenes



	Mode	Concept	Typical scene	Monitor
Driving Style	POWER	Amazing acceleration produced by the electric power	Acceleration for overtaking on highway	
	ECO	Eco friendly driving	City	
Driving scene	NORMAL	Sufficient reliability for SUV in various road conditions	Basic mode	
	TARMAC	Pleasure of driving with agile dynamics on dry paved road	Winding dry paved road	
	GRAVEL	Powerful and stable driving on unpaved road	Unpaved road, Wet road	
	SNOW	Secure driving with grip on snow and ice roads	Snow and ice roads	
	MUD	Powerful and confident driving on mud and deep-snow	Mud, Deep snow	