All-Wheel Drive Mercedes-Benz SUV

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What drives us?

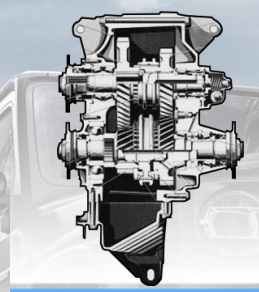
Agenda

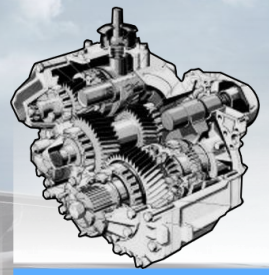
All-Wheel Drive Mercedes-Benz SUV

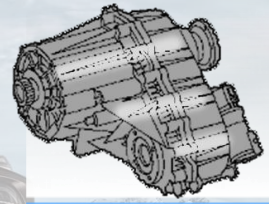
1. 40 years SUV All-Wheel-Drive System
2. Technical Targets
3. All-Wheel-Drive Powertrain
4. GLE-Class Torque-on-Demand Transfer Cases
5. G-Class Transfer Case
6. Development Process and Validation

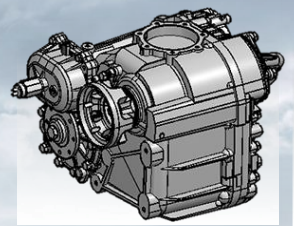
All-wheel drive system development in Mercedes-Benz SUVs of the last 40 years

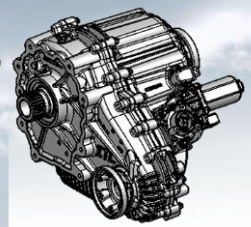
Technical performance


VG 080

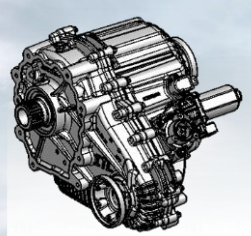

VG 150

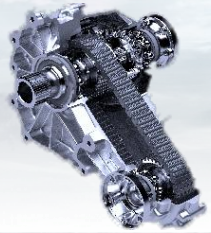

VG 2Sp


VG 150E

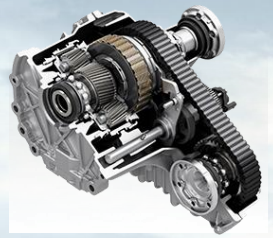

ITC 2Sp

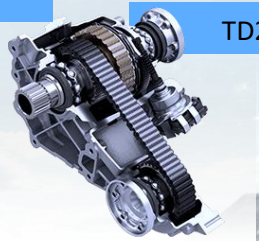
ITC 1Sp


ITC+ 2Sp


ITC+ 1Sp

FT46


TD228


TD116

Torque-on-Demand AWD systems

Permanent AWD with open diff. (1989 to present)

Manually selectable AWD with open diff. (1979 to 2001)

1979 1989 1997 2005 2015 2018 2019

G (W460) | G (W463) | ML (W163) | ML (W164) | ML/GLE (W166) | GLE Coupé (C292) | G (W463 new) | GLS (X167)

G (W461) | R (W251) | GL (X164) | GL/GLS (X166) | X (BR470) | GLE (V167)

All-wheel drive system development in Mercedes-Benz SUVs of the last 40 years

FT46

TD116

TD228

G (W463 new)

X (BR470)

GLE (V167)

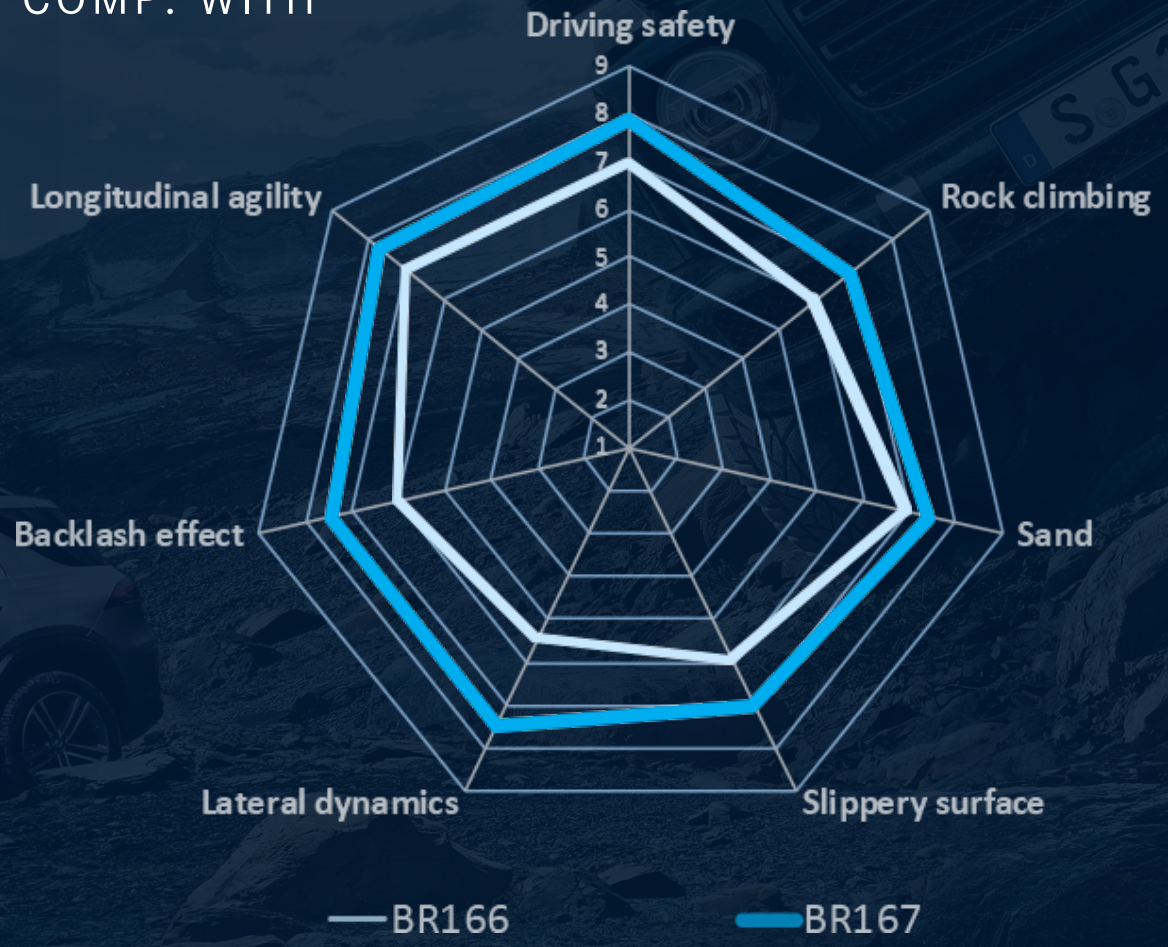
GLS (X167)

Development goals of the new all-wheel drive systems

TD116

TD228

BR167 COMP. WITH BR166



Development goals of the new all-wheel drive systems

Further objectives with regard to the vehicle integration of the transfer cases:

- Efficient operation with low drag torque
- Mercedes-Benz corrosion standards
- Damage-free endurance of the resulting peak torques
- unobtrusive operation of the transfer cases

Development goals of the new all-wheel drive systems

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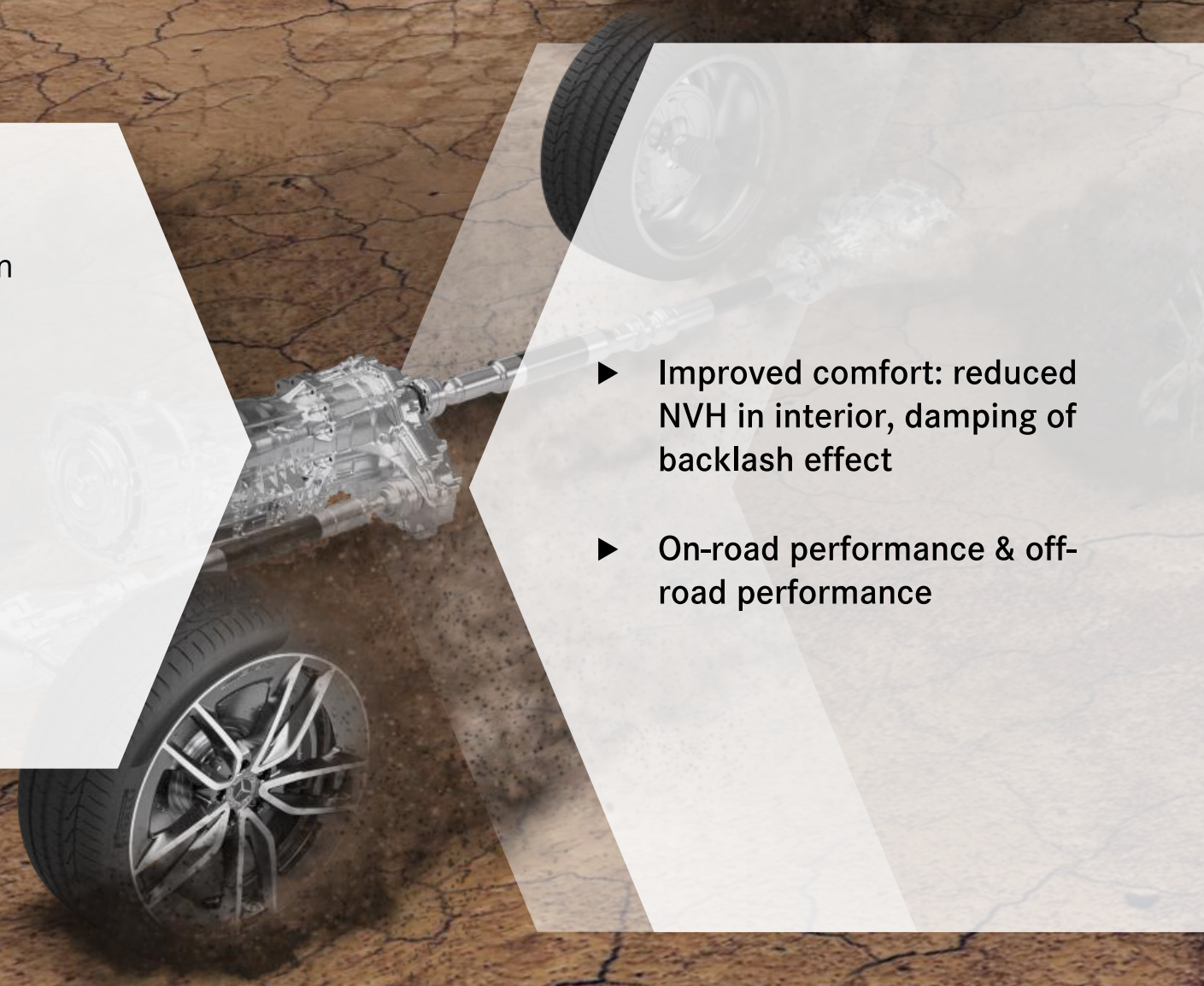
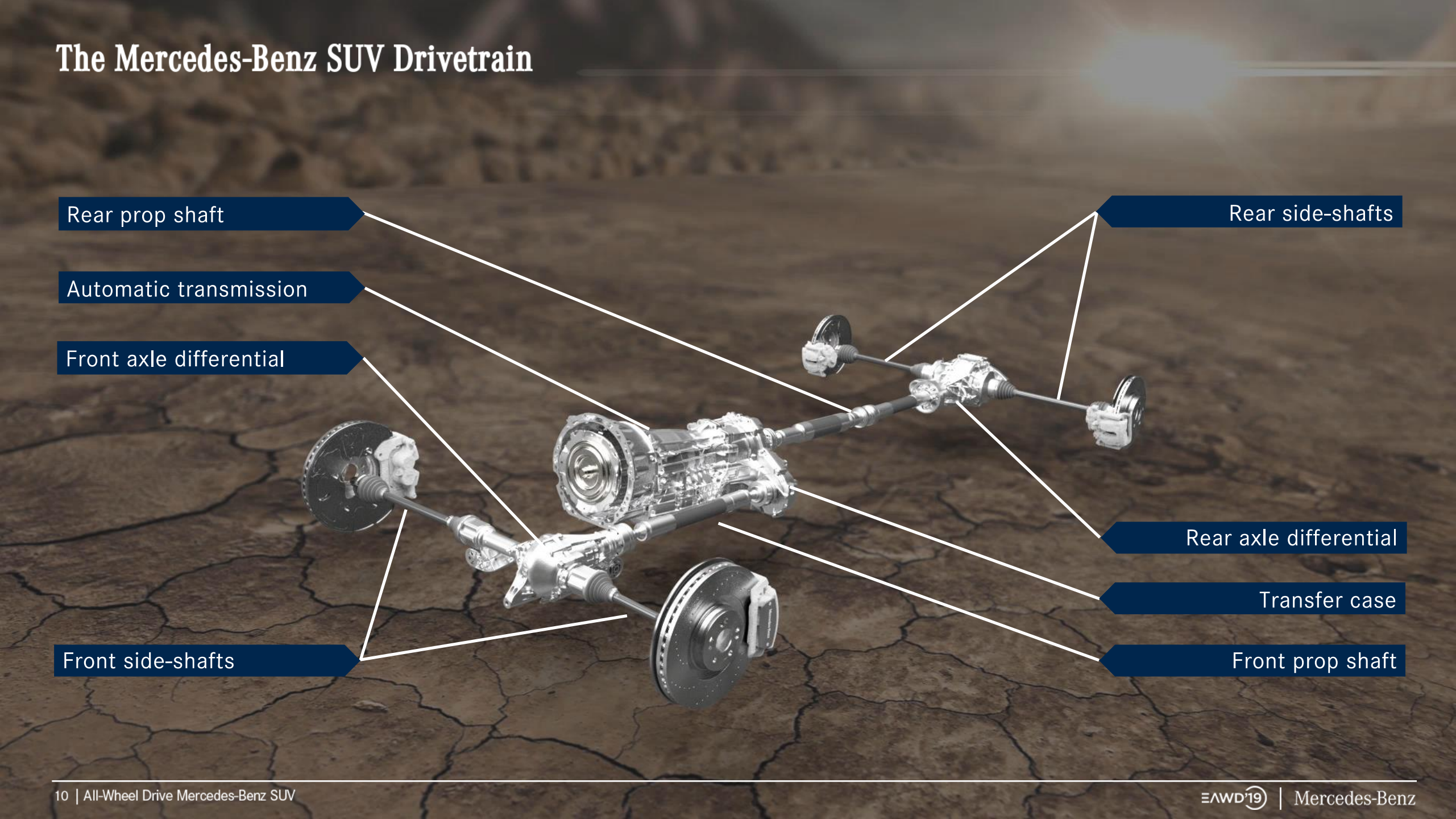
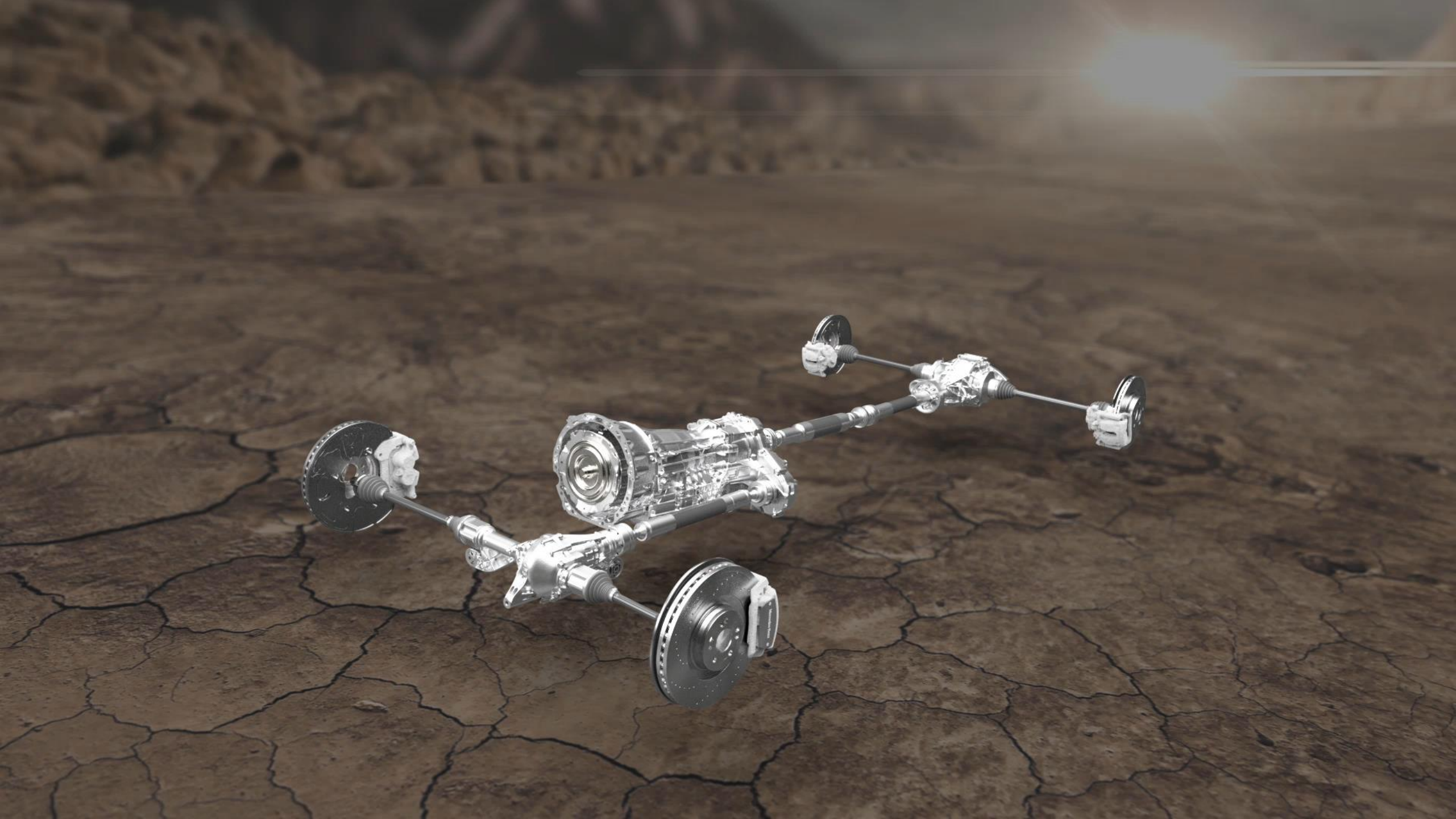


- **Improved comfort: reduced NVH in interior, damping of backlash effect**
- **On-road performance & off-road performance**

The Mercedes-Benz SUV Drivetrain

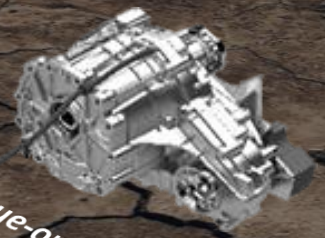




The Mercedes-Benz SUV powertrain modular strategy

The Mercedes-Benz SUV powertrain modular strategy

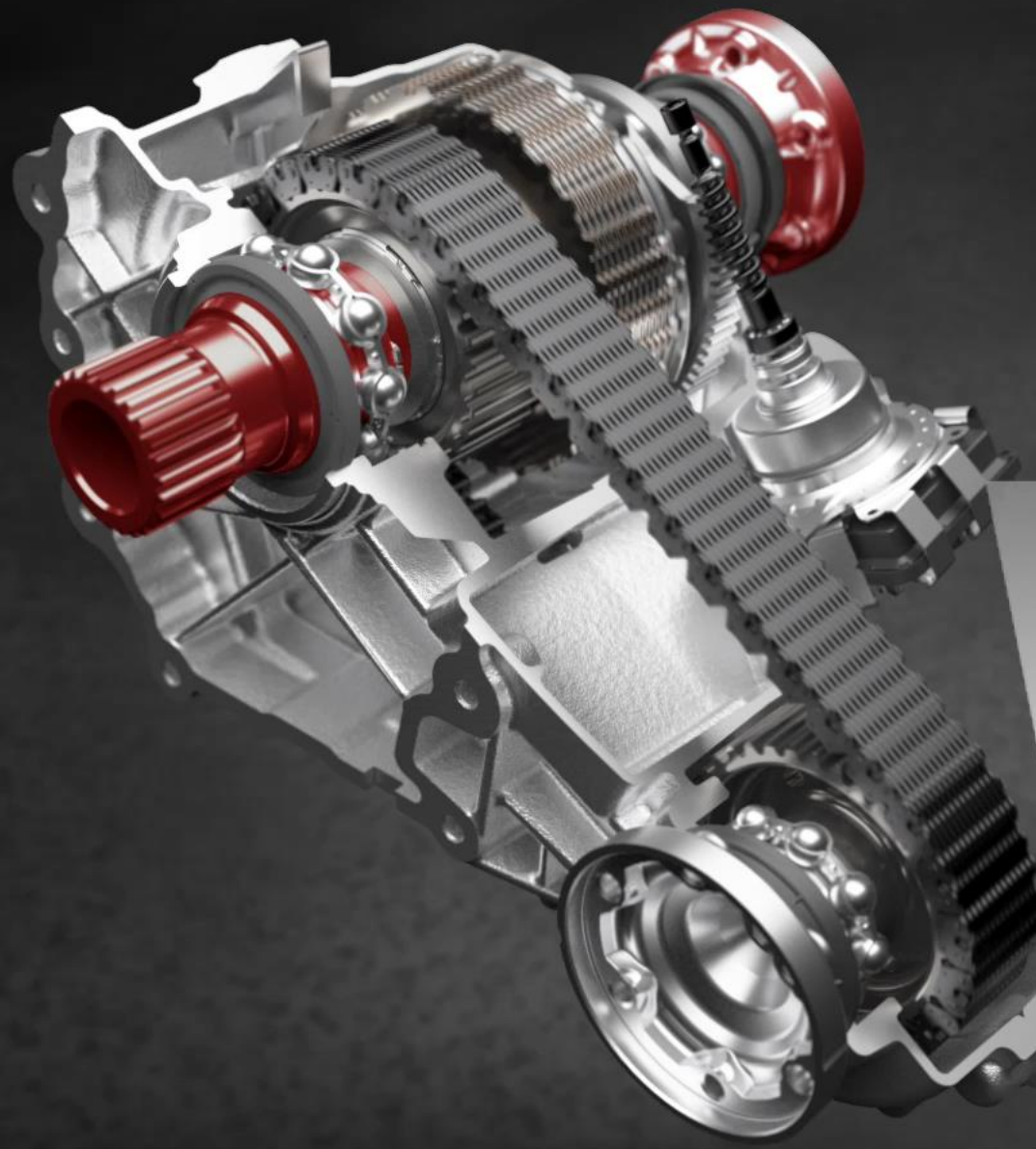
Torque-on-Demand transfer case



Torque-on-Demand transfer case with off-road gear

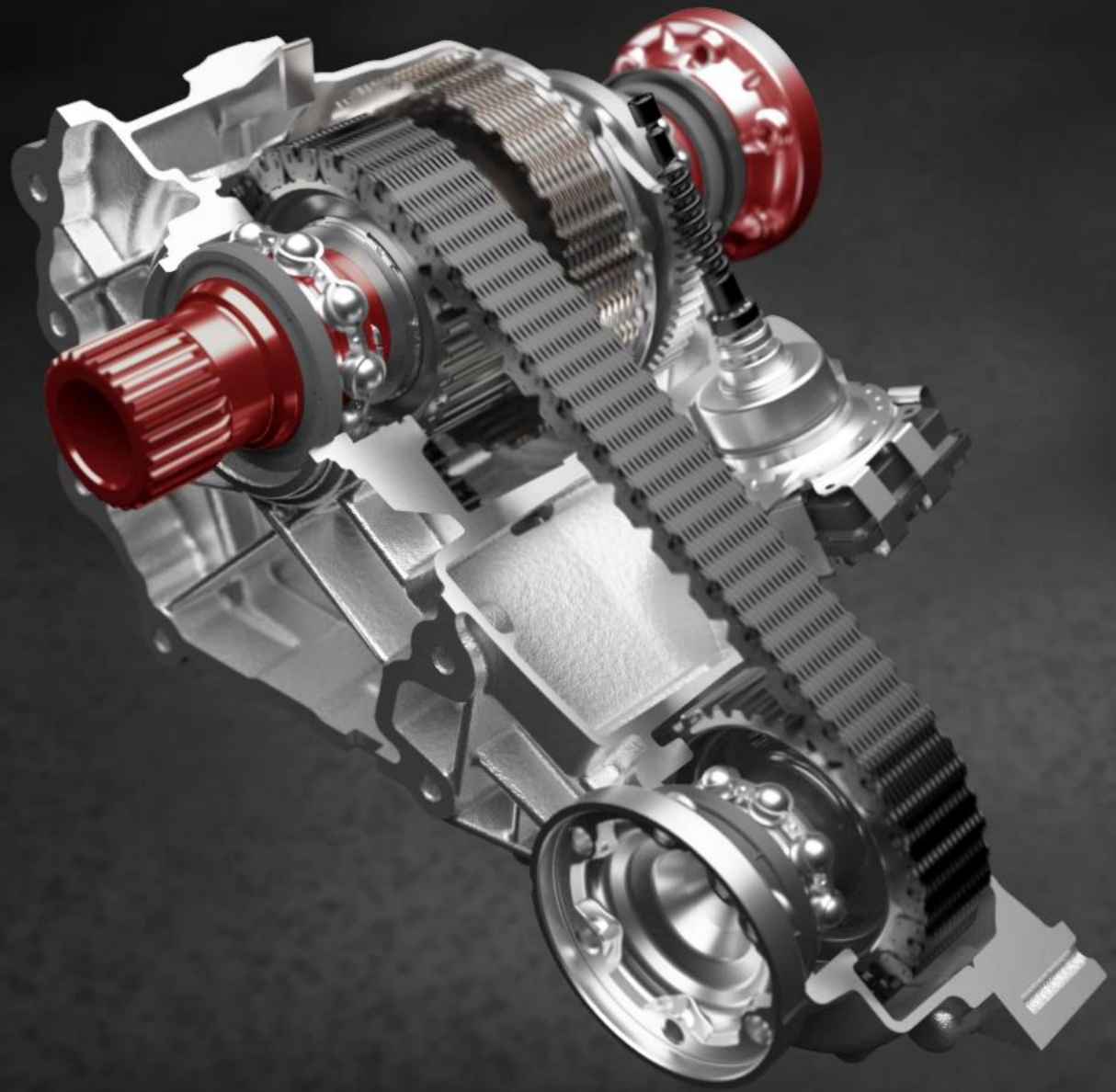
40:60 transfer case with off-road gear

Torque-on-Demand transfer case

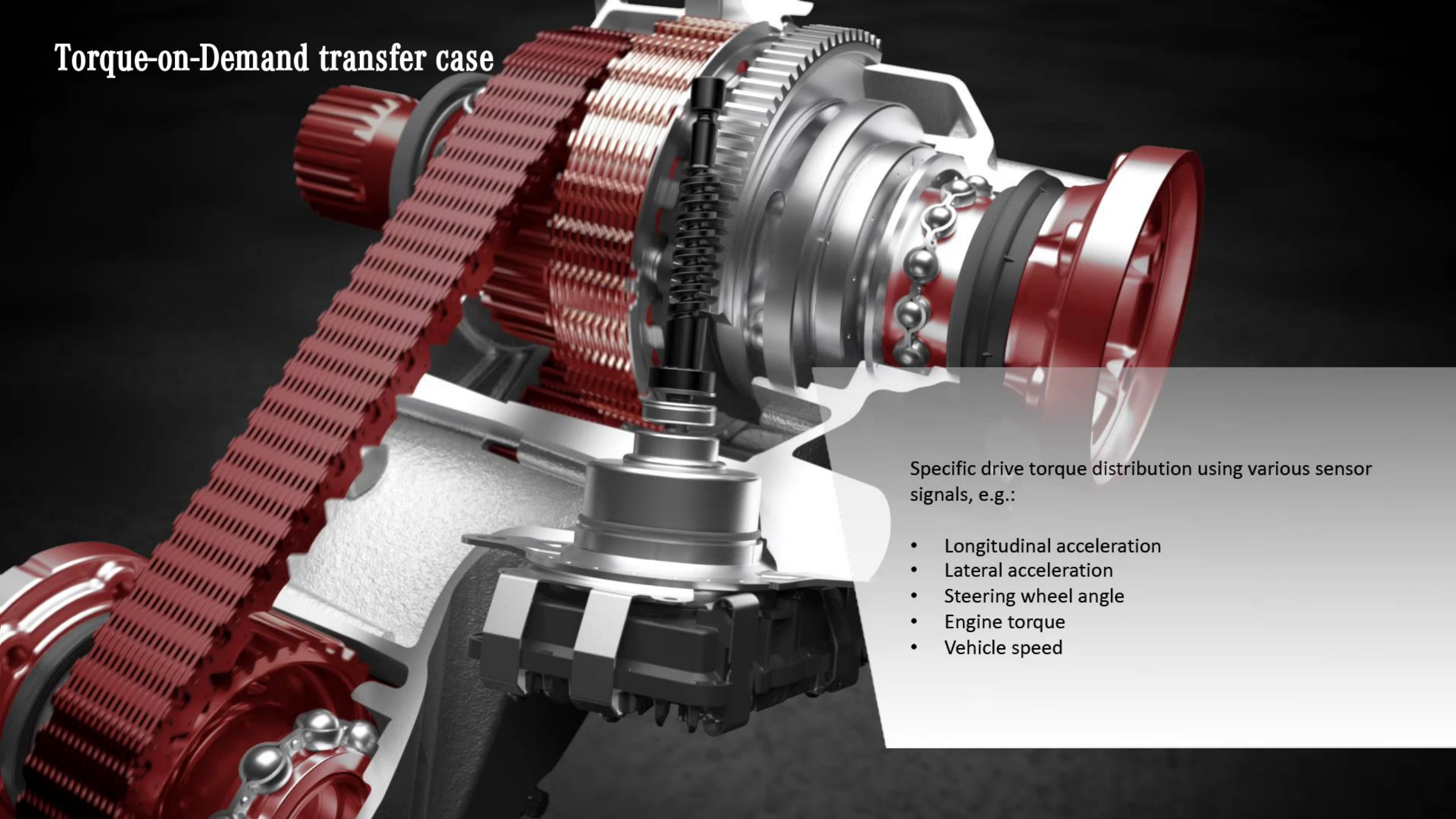


- Torque distribution: variable
- Clutch torque: 1,600 Nm nominal value
- Weight: 23.7 kg
- Lubrication concept: passive lubrication
- Oil capacity: 750 ml
- Maximum input torque: 2,800 Nm
- Maximum input shaft speed: 7,000 rpm

Torque-on-Demand transfer case

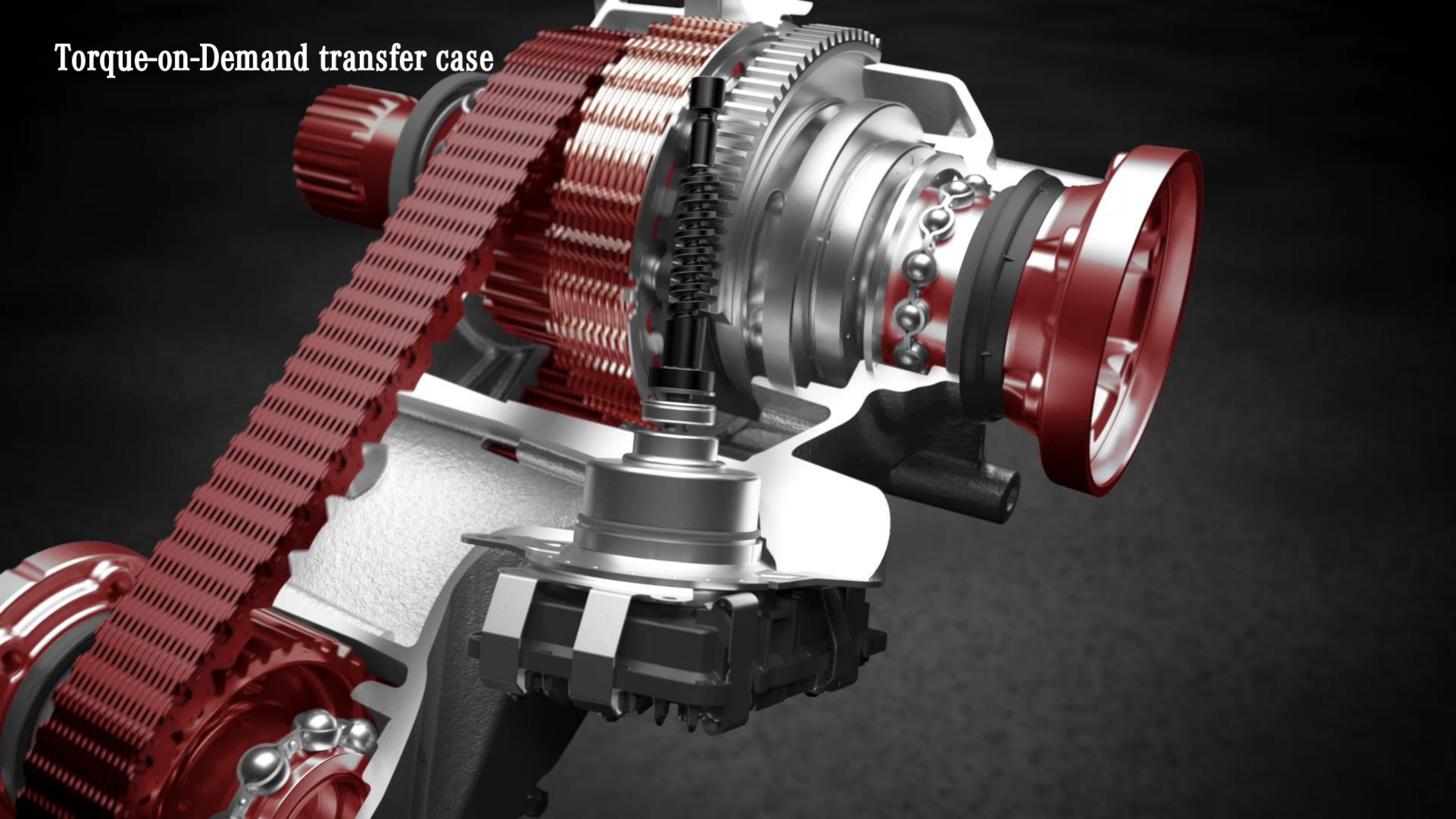


Torque-on-Demand transfer case



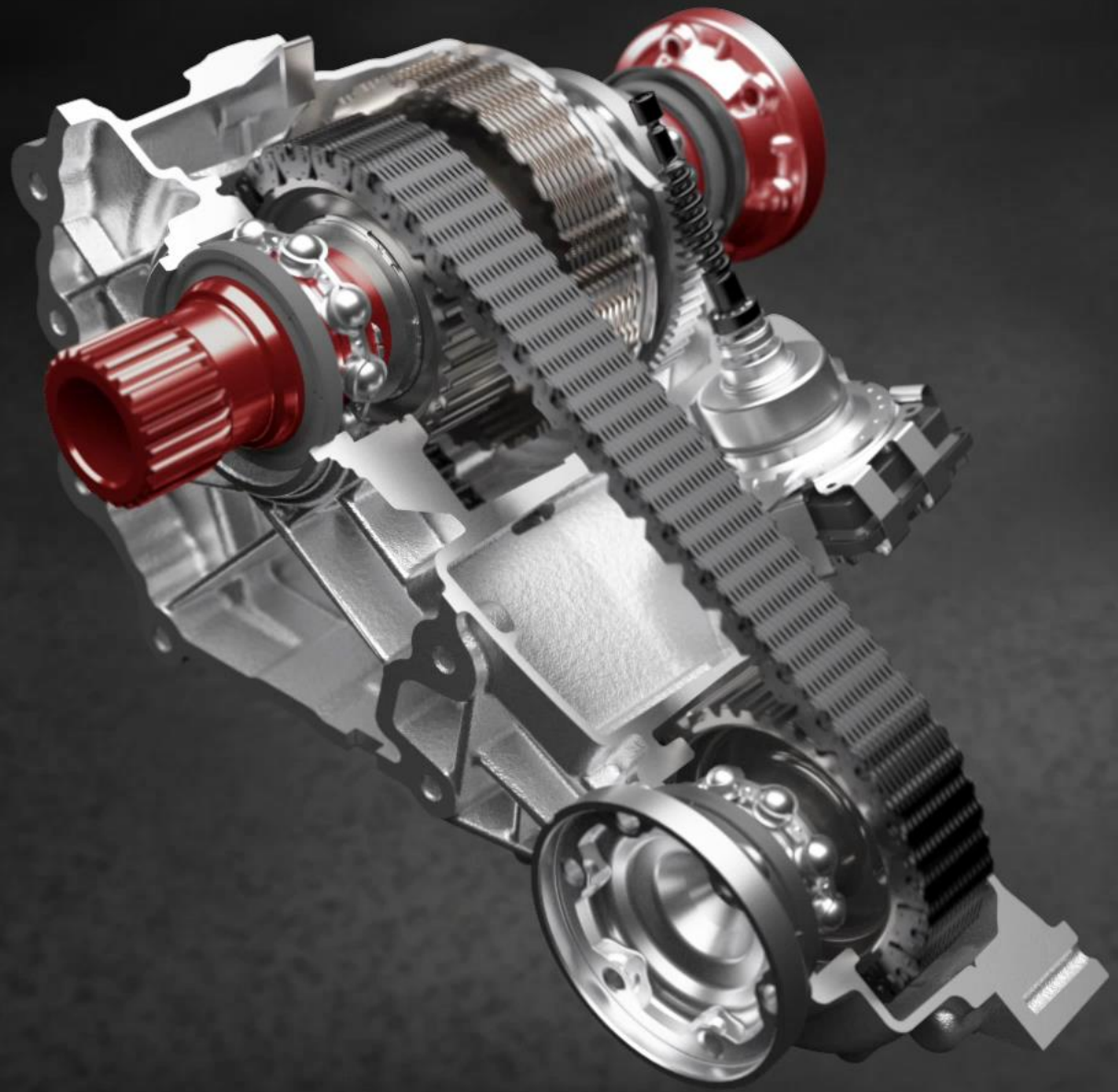
Specific drive torque distribution using various sensor signals, e.g.:

- Longitudinal acceleration
- Lateral acceleration
- Steering wheel angle
- Engine torque
- Vehicle speed

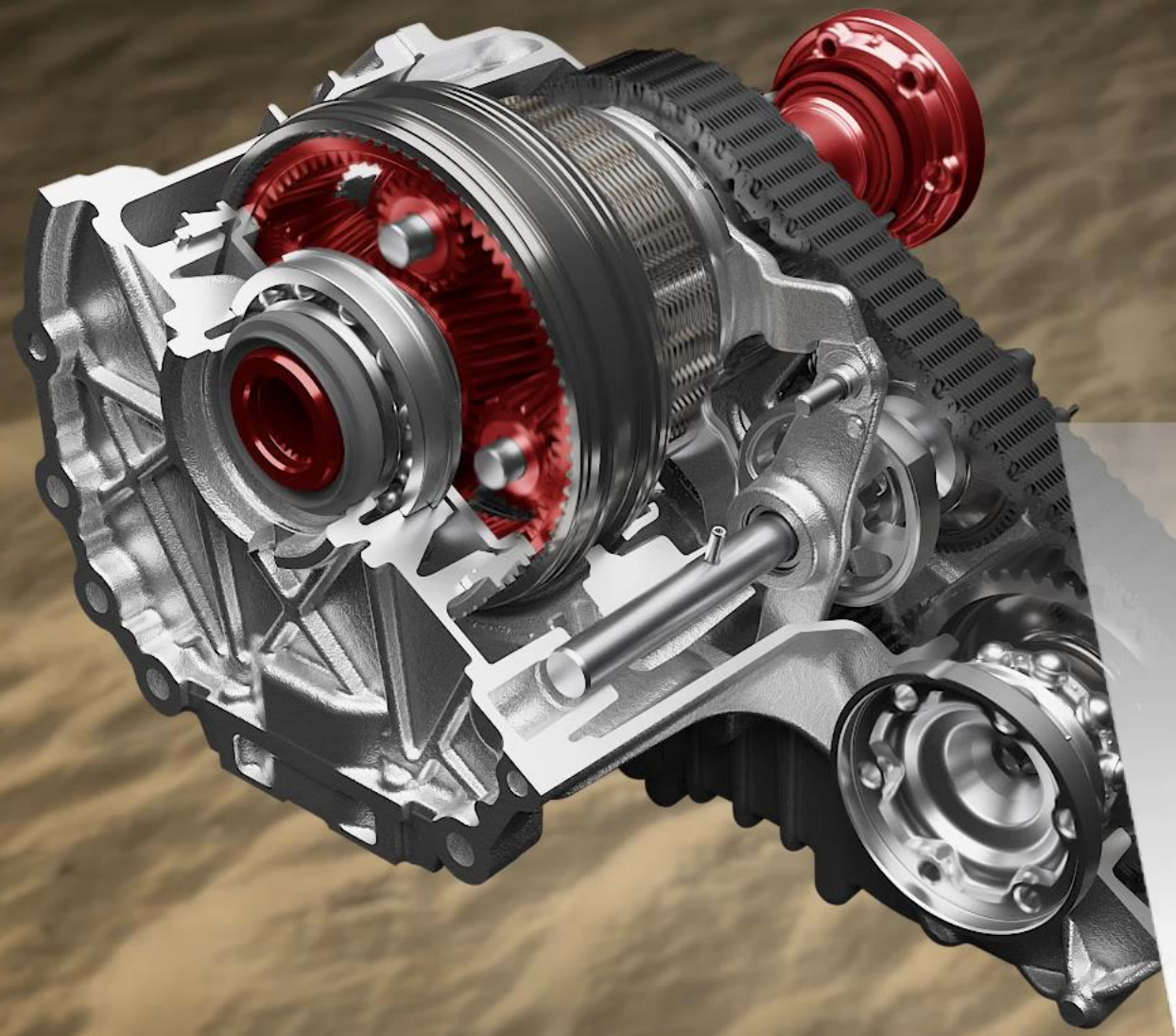

Torque-on-Demand transfer case

Torque-on-Demand transfer case

Torque-on-Demand transfer case with off-road gear

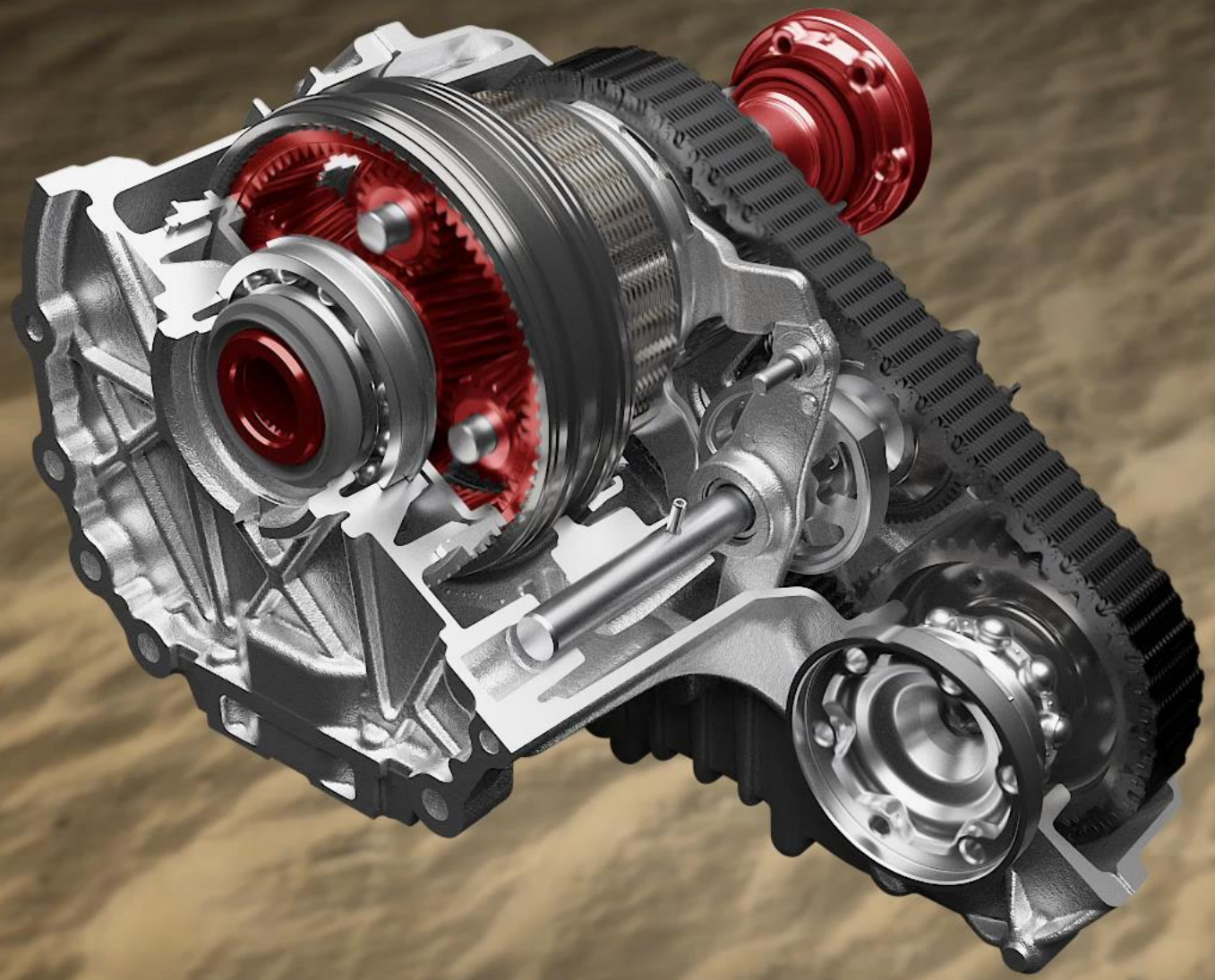


Torque-on-Demand transfer case with off-road gear

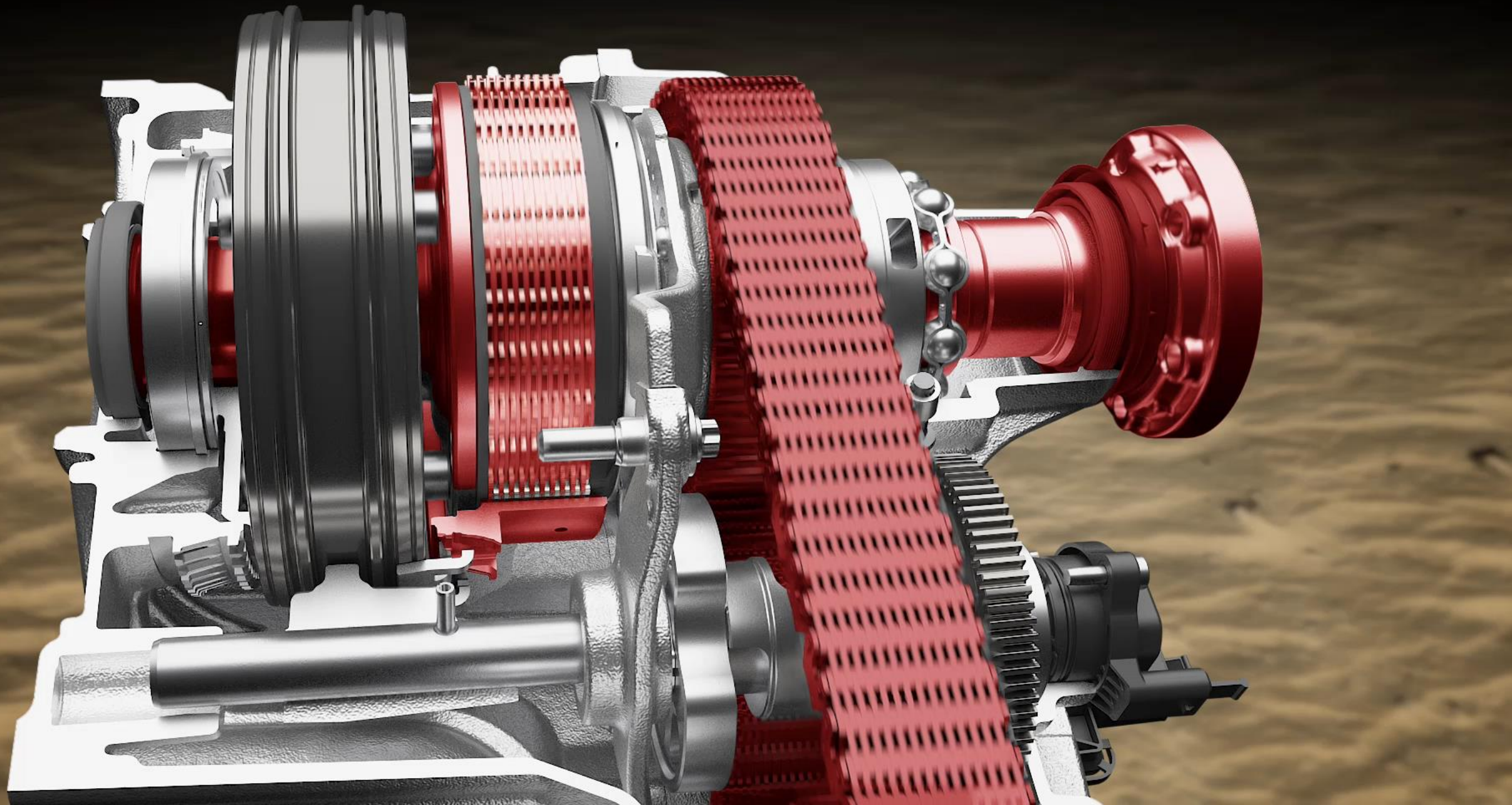


- Torque distribution: variable
- Clutch torque: 2,800 Nm nominal value
- Low range gear ratio: i = 2.93 by planetary gear set with 4 planets
- Synchronization: low-high shifting, synchronized
- Weight: 41.4 kg
- Lubrication concept: active lubrication by oil pump as well as passive lubrication
- Oil capacity: 1,500 ml
- Maximum input torque: 2,800 Nm
- Maximum input shaft speed: 7,000 rpm

Torque-on-Demand transfer case with off-road gear



Torque-on-Demand transfer case with off-road gear



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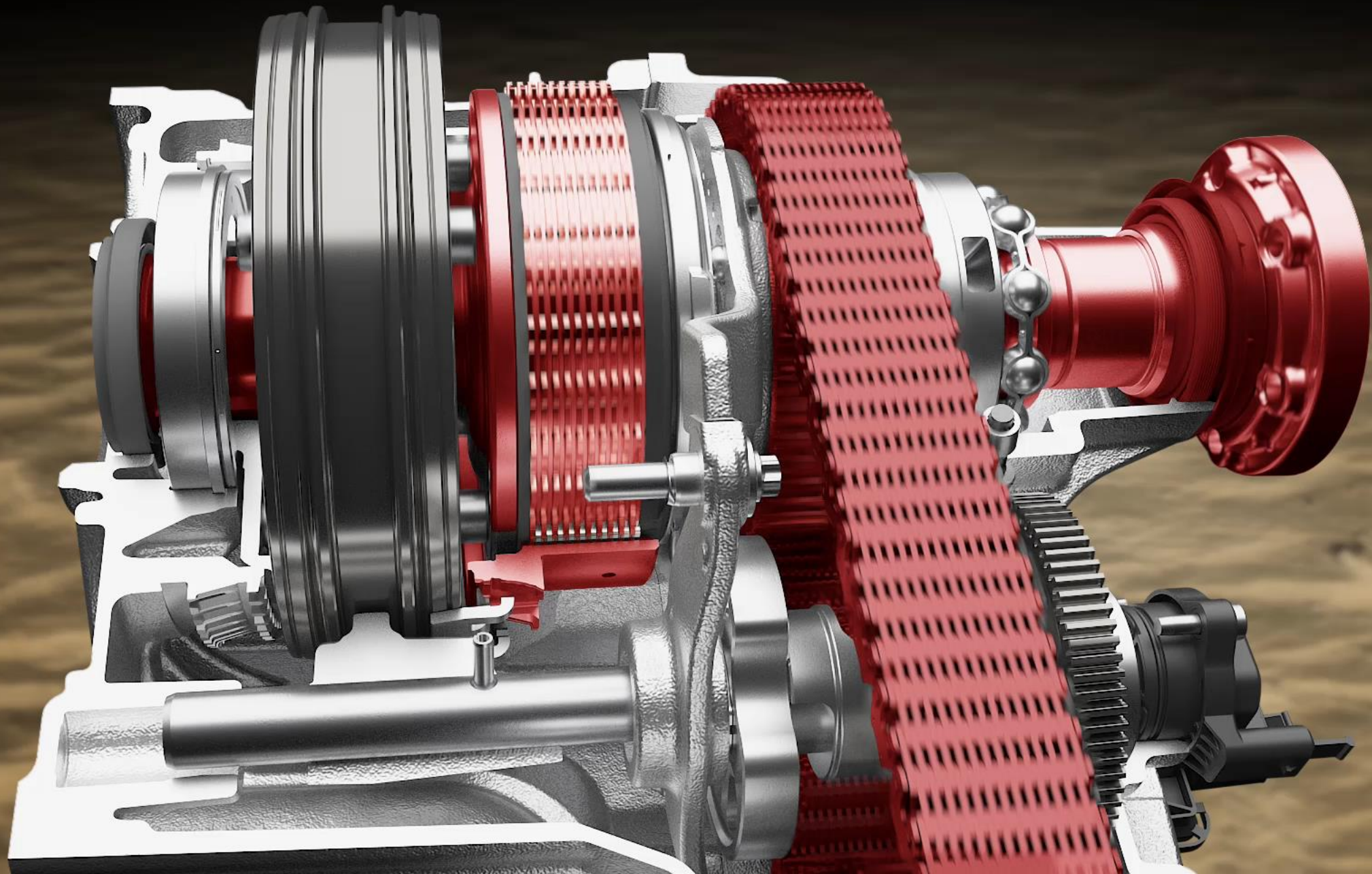
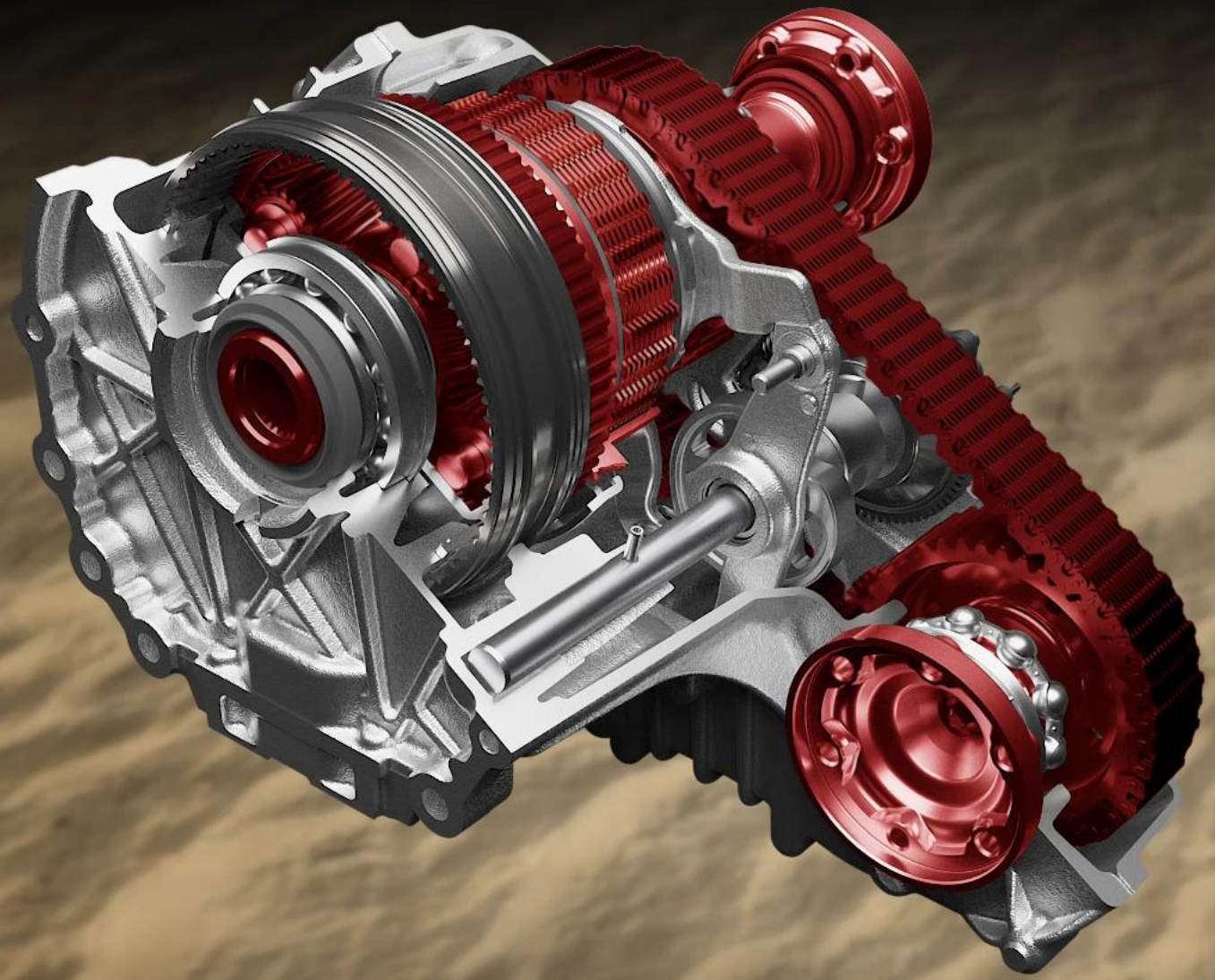
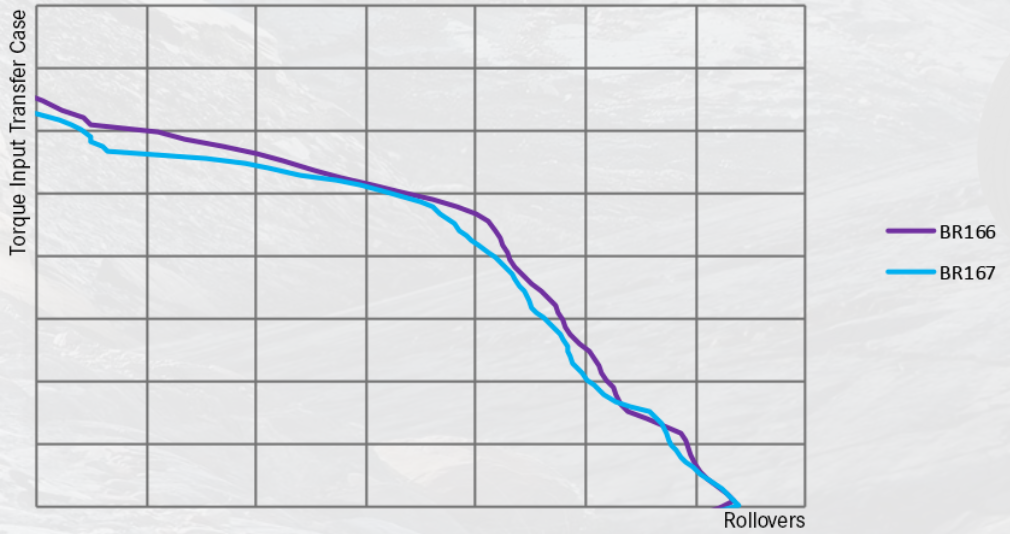


Torque-on-Demand transfer case with off-road gear



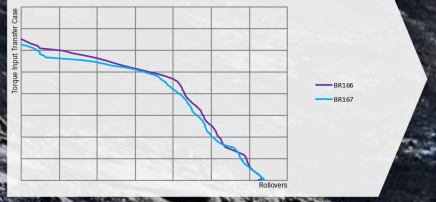
Effect of TonD Load Collectives on Drivetrain

Damage comparison of similar vehicles of the 166 and 167 model series

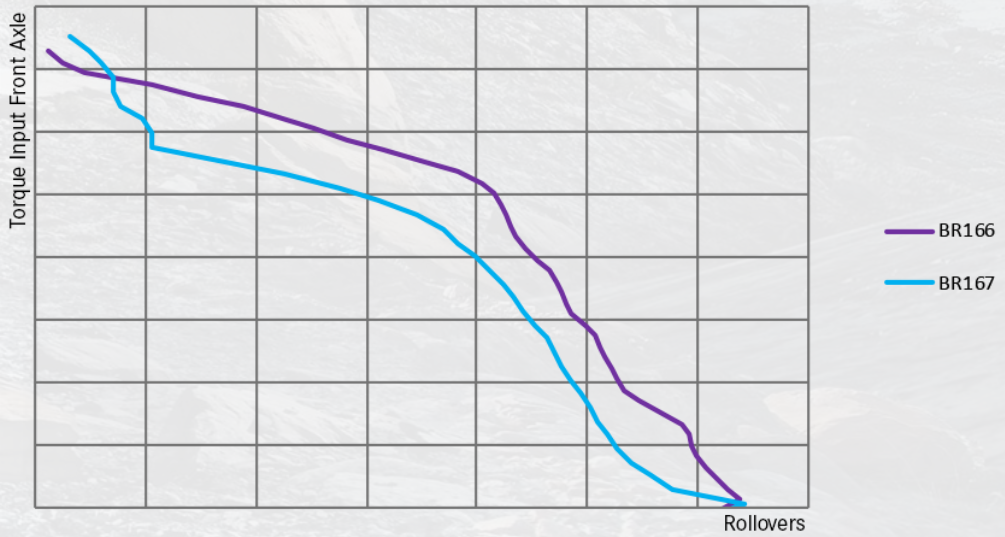


Effect of TonD Load Collectives on Drivetrain

Damage comparison of similar vehicles of the 166 and 167 model series



Comparison of revolutions at the front axle



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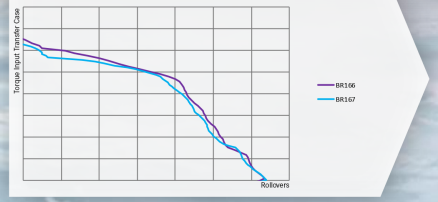

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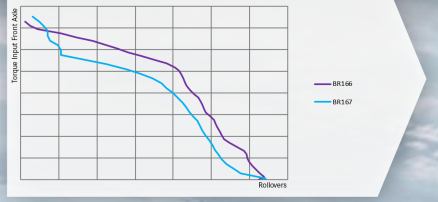
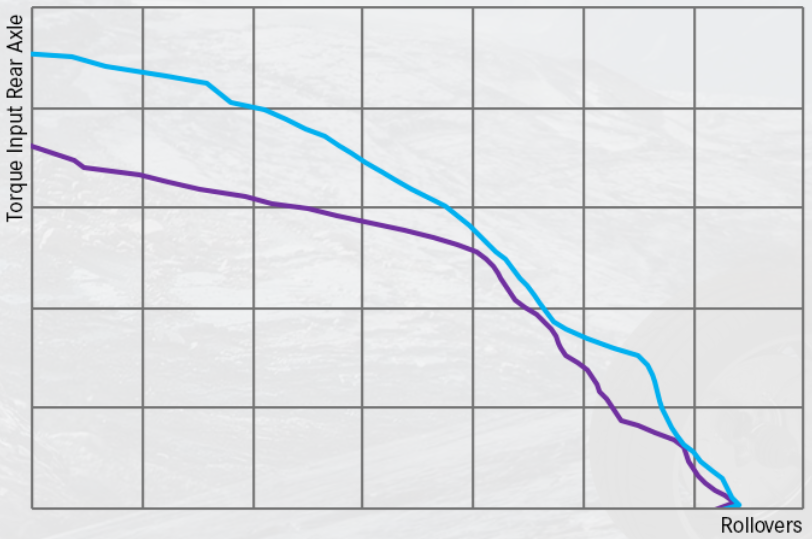


Comparison of revolutions at the rear axle



Effect of TonD Load Collectives on Drivetrain

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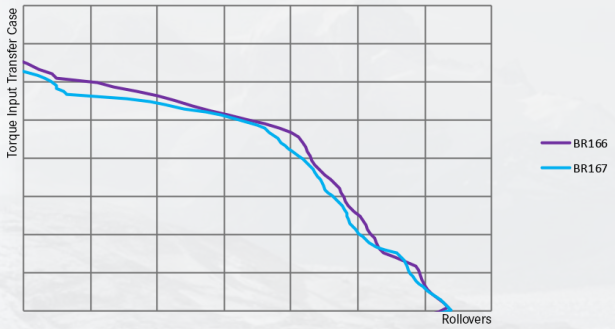

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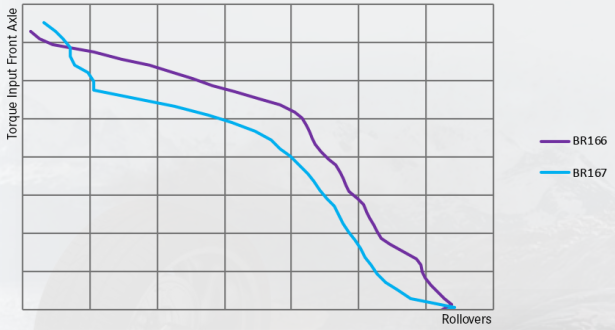
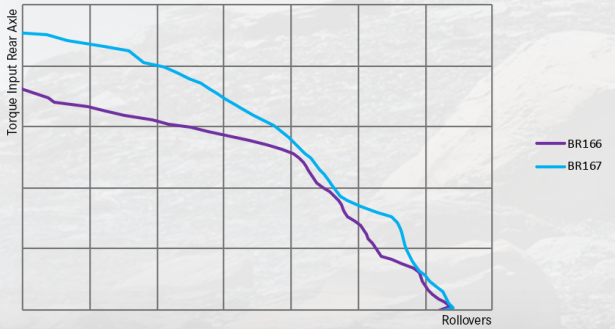
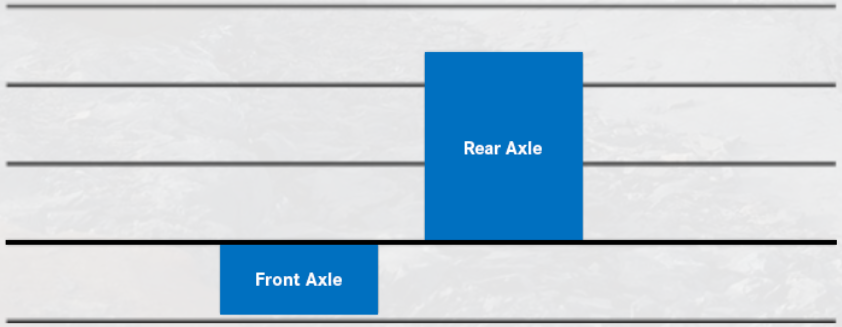


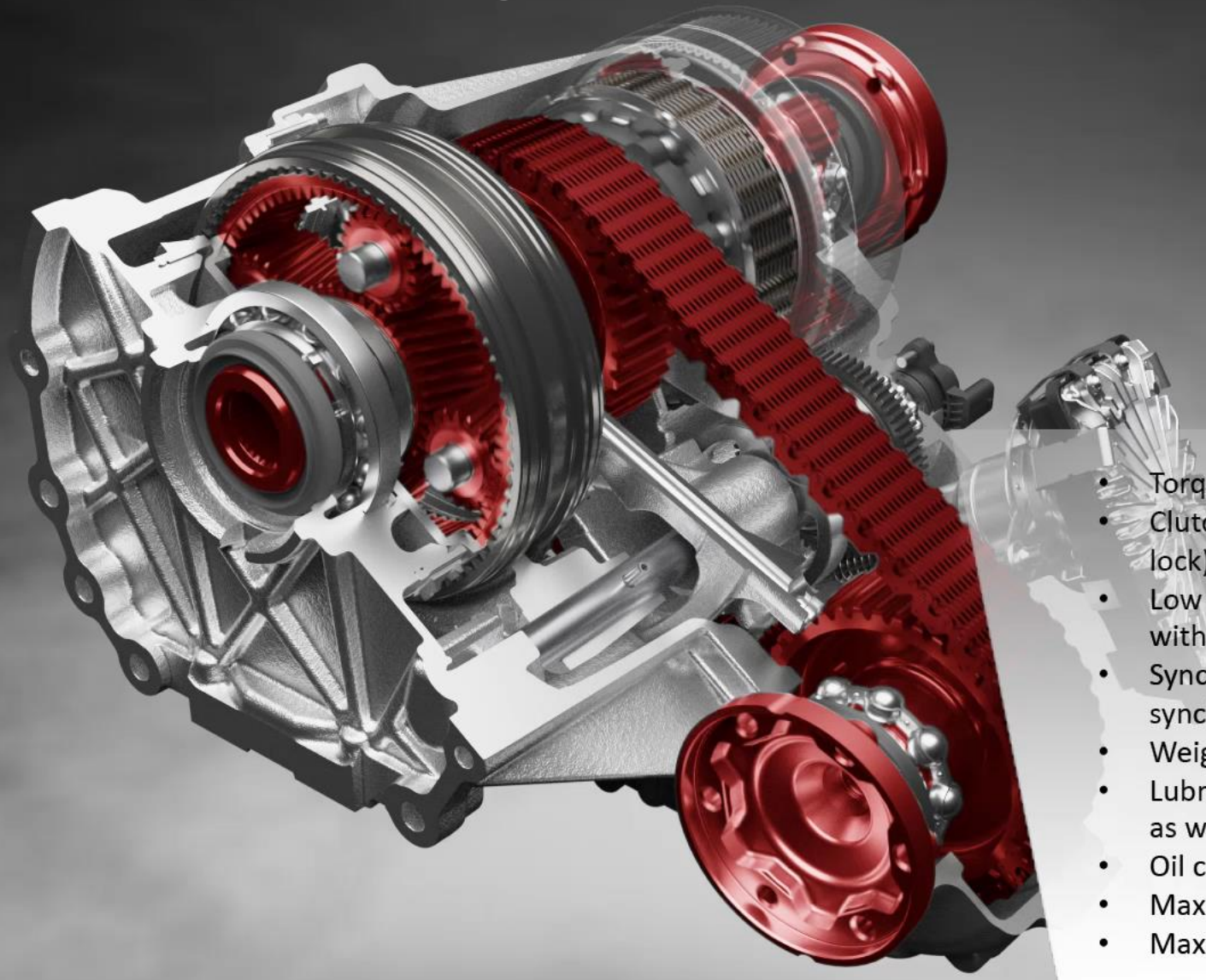
Comparison of revolutions at the rear axle



Change of Damage



40:60 transfer case with off-road gear



- Torque distribution: 40% / 60% by planetary gear set
- Clutch torque: 1600 Nm nominal value (longitudinal lock)
- Low range gear ratio: i = 2.93 by planetary gear set with 4 planets
- Synchronization: low-high and high-low shifting synchronized
- Weight: 50.8 kg
- Lubrication concept: active lubrication by oil pump as well as passive lubrication
- Oil capacity: 1,500 ml
- Maximum input torque: 2,800 Nm
- Maximum input shaft speed: 7,000 rpm

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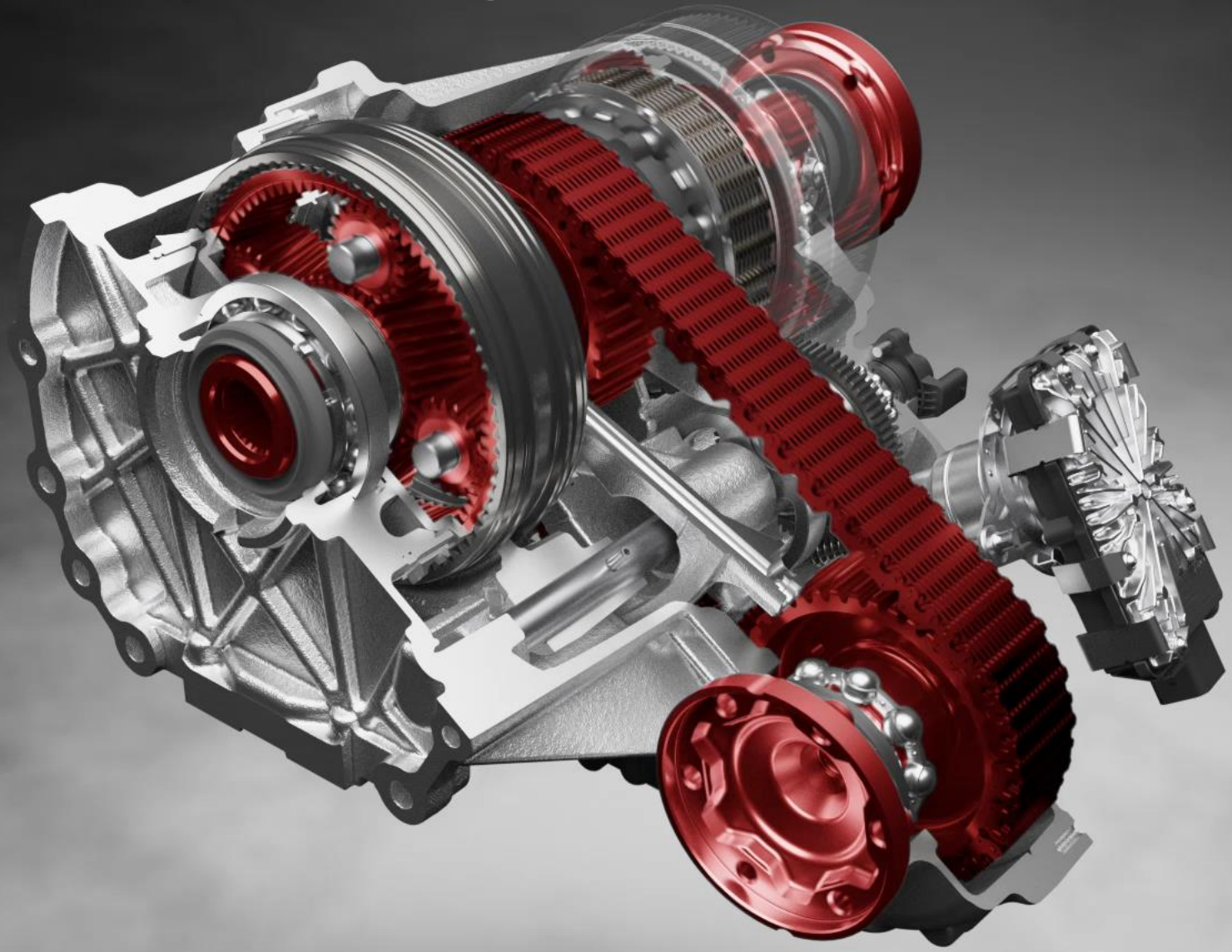

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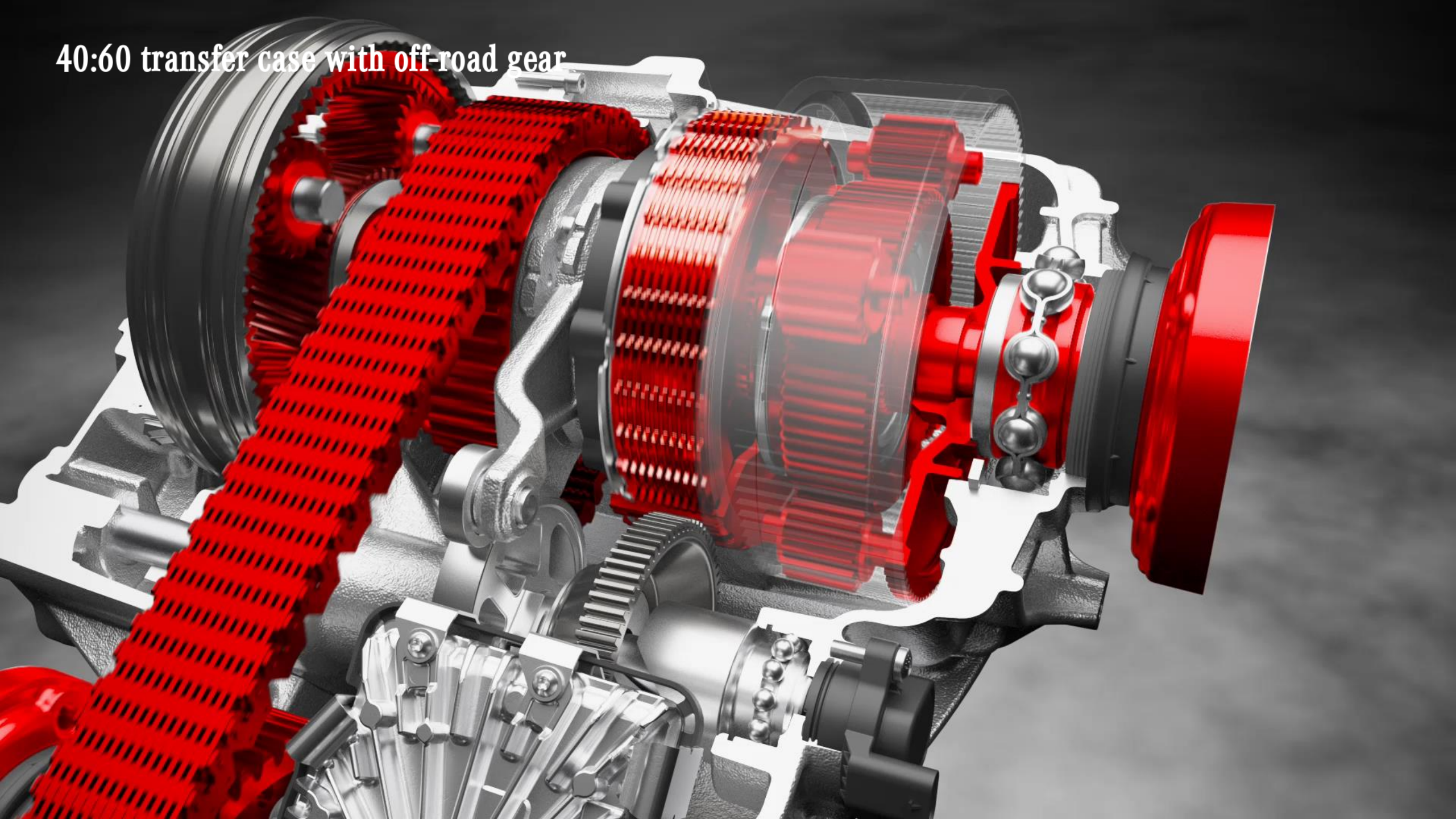

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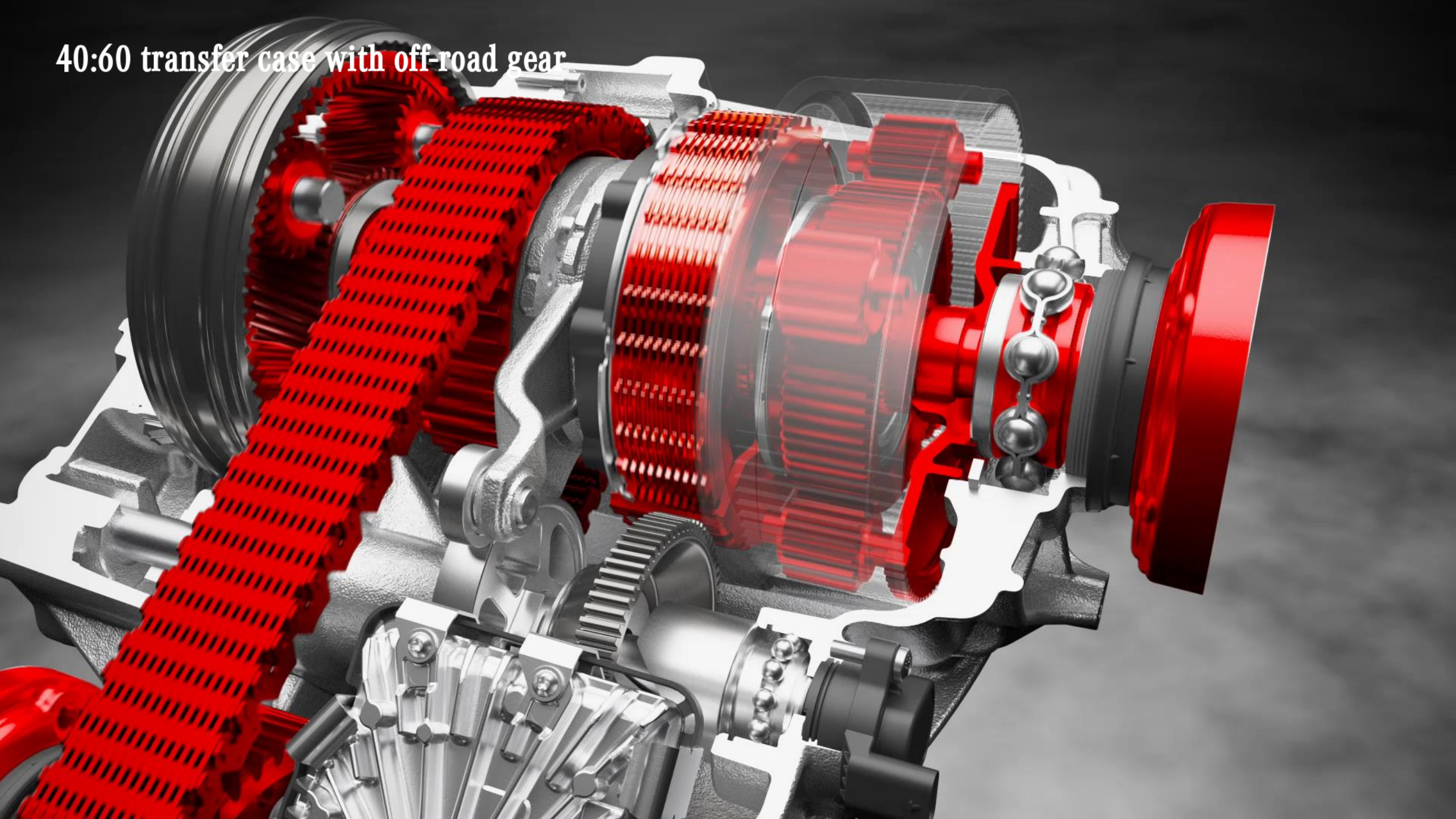

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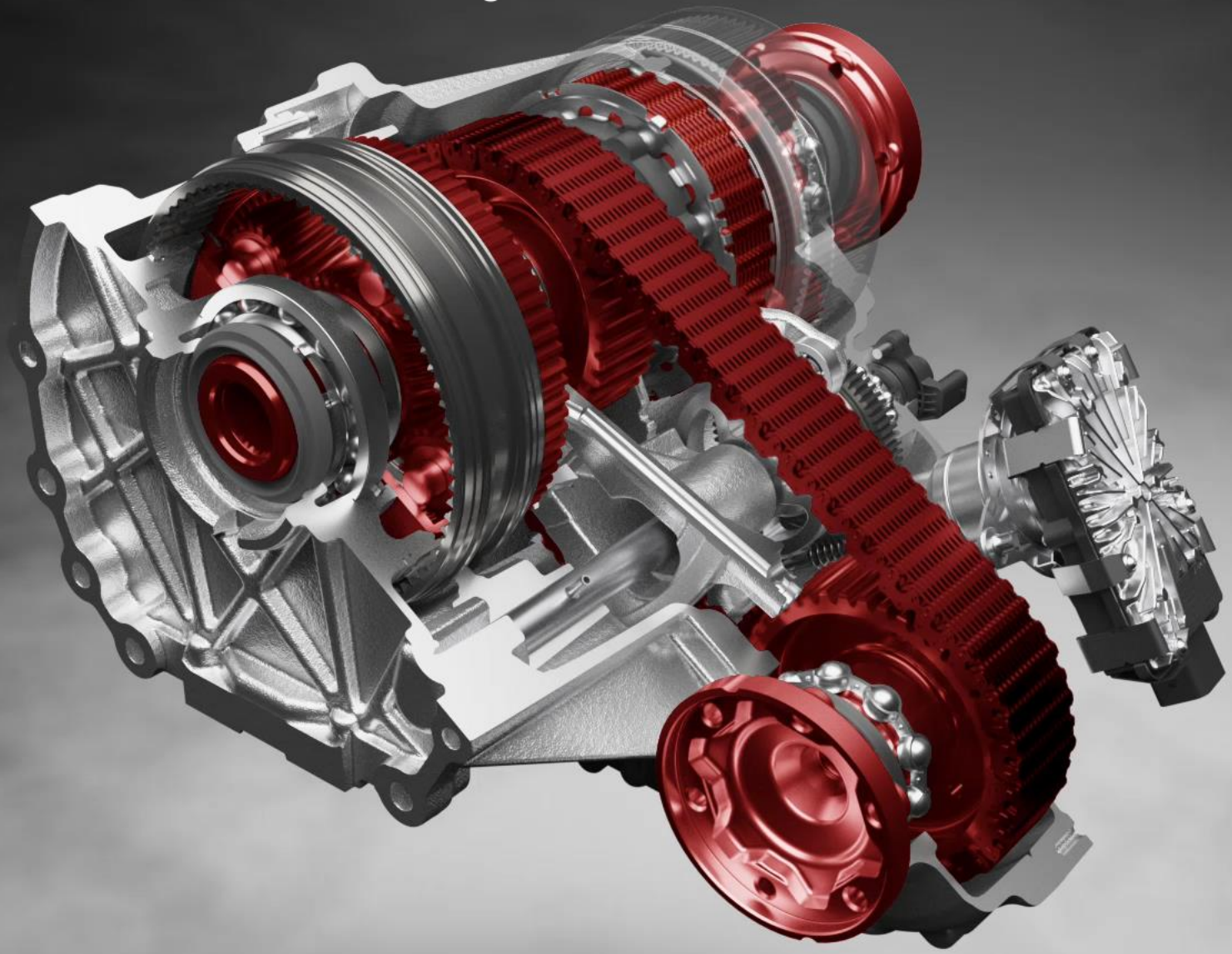


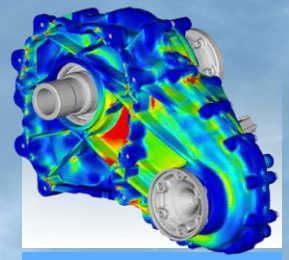
Development process and validation

Concept & digital validation | Prototype generation | Off-tool parts | Off-process parts

Supplier

Component Validation

Design



NVH simulations

CAx component validation

Component test rigs

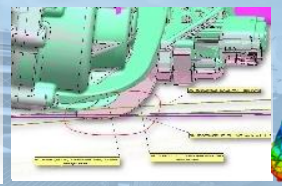
Manufacturing

OEM

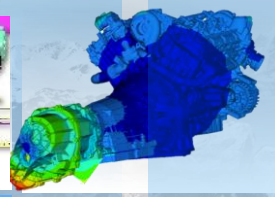
System Validation

1
2
3

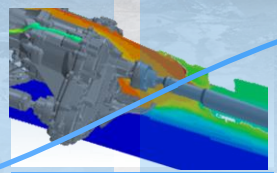
Requirement specification



Design



NVH simulations



CAx vehicle validation

3M test rigs

VKM test rigs

Vehicle test drive

Vehicle endurance tests

Total test rig km around:

7 million km

Total test rig km around:

14 million km

Total vehicle km around:

13,25 million km

Thank you.