

Background

- Society of Automotive Engineers competition team
- Design a prototype off-road racing vehicle with the goal of full product development
- CU has been a competition team since 2015-2016
- Second 4WD vehicle designed by CU

Design Goals

- Reduce vehicle weight: 580 lbs → 530 lbs
- Reduce turning radius: 130 in → 80 in
- Increase top speed: 17 mph → 22 mph
- Suspension travel: 11 in
- Static ride height: 9 in
- Increase drivetrain reliability

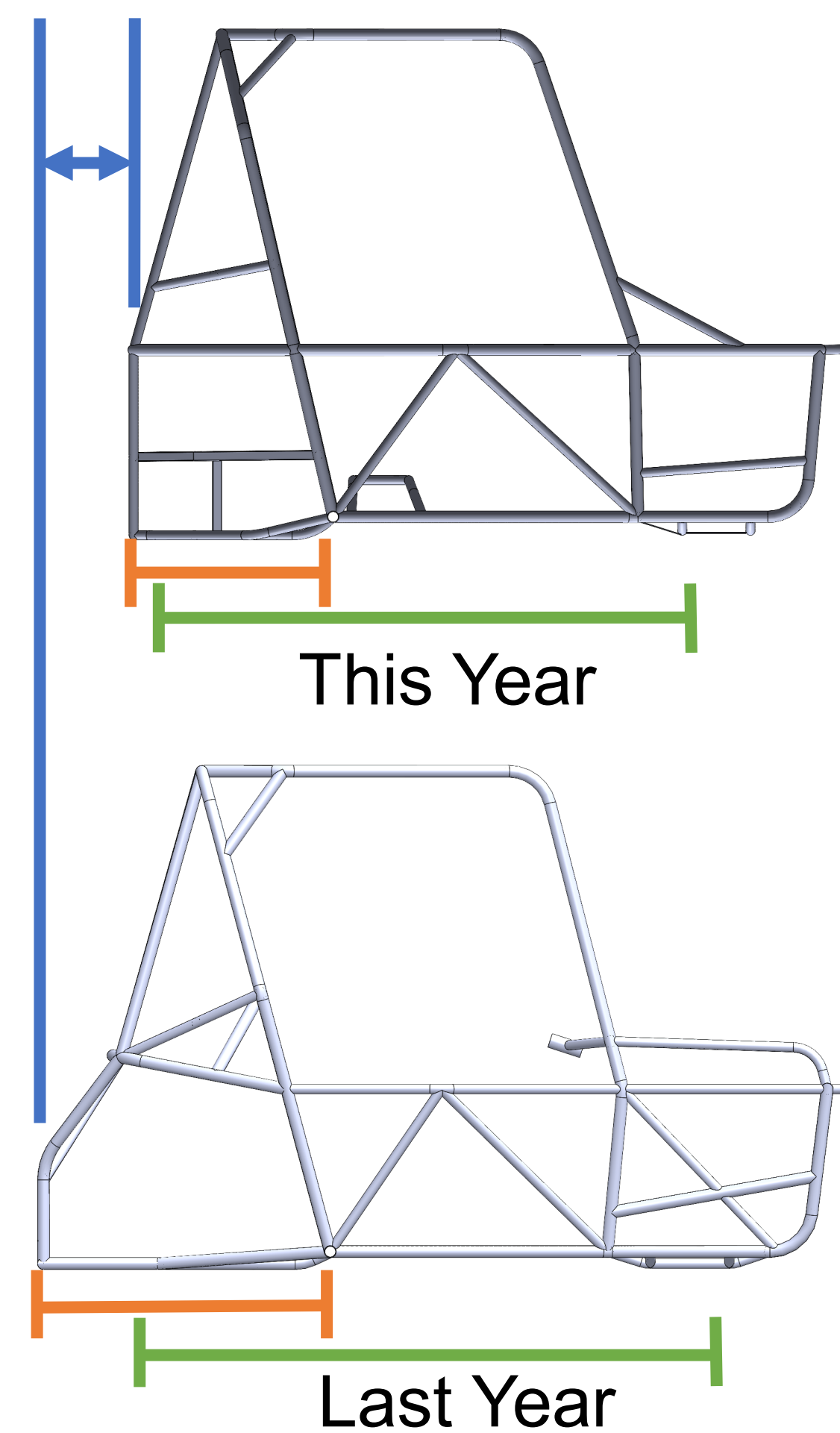
Chassis

Chassis length reduced by 11 in to reduce weight

Chassis weight reduced by 20 lbs

Rear end length shortened by 8 in to reduce turning moment

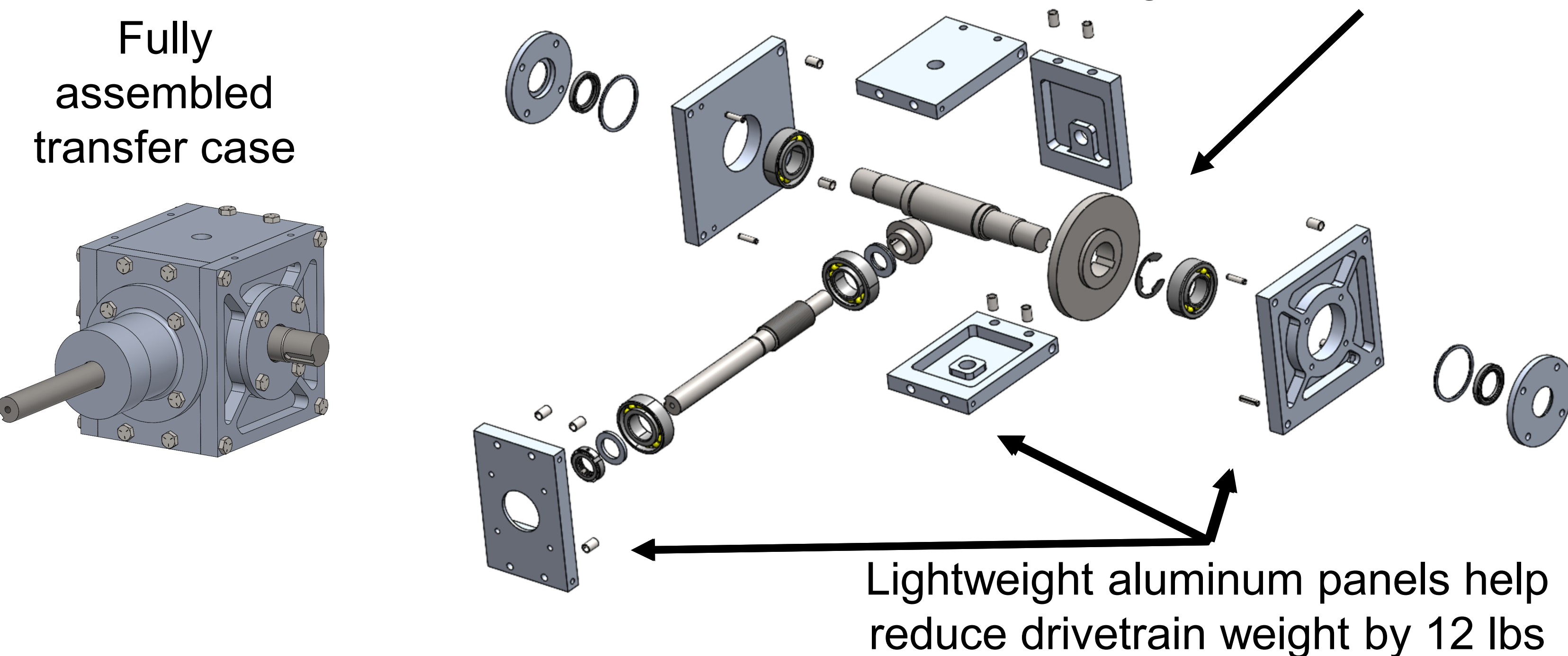
Wheelbase reduced by 5 in to reduce turning radius



Drivetrain

Custom 3:1 Transfer Case

Custom shafts, gear, and bearing arrangement to minimize volume

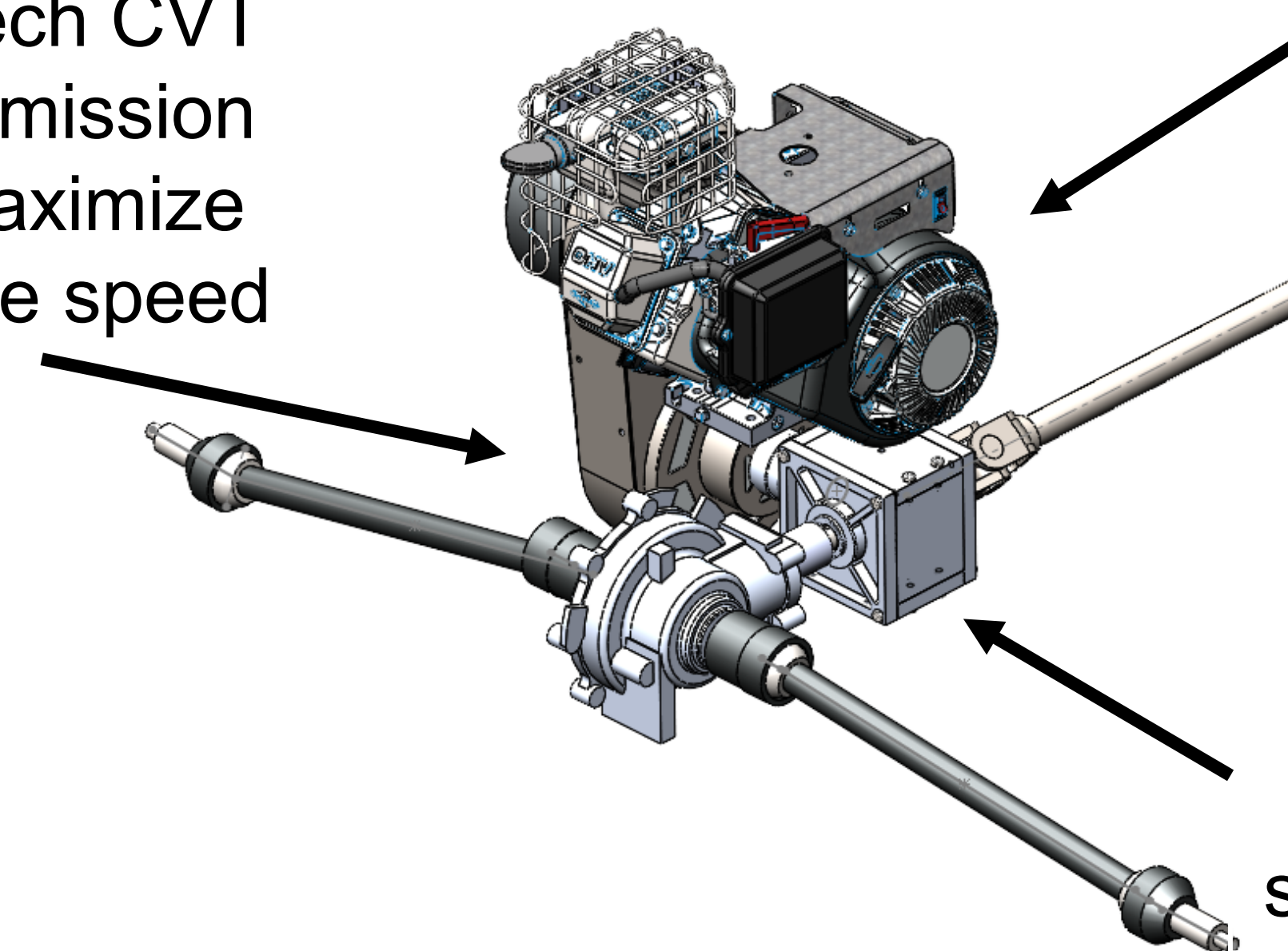


Custom 4 Wheel Drive System

Mounting engine above transfer case reduces length

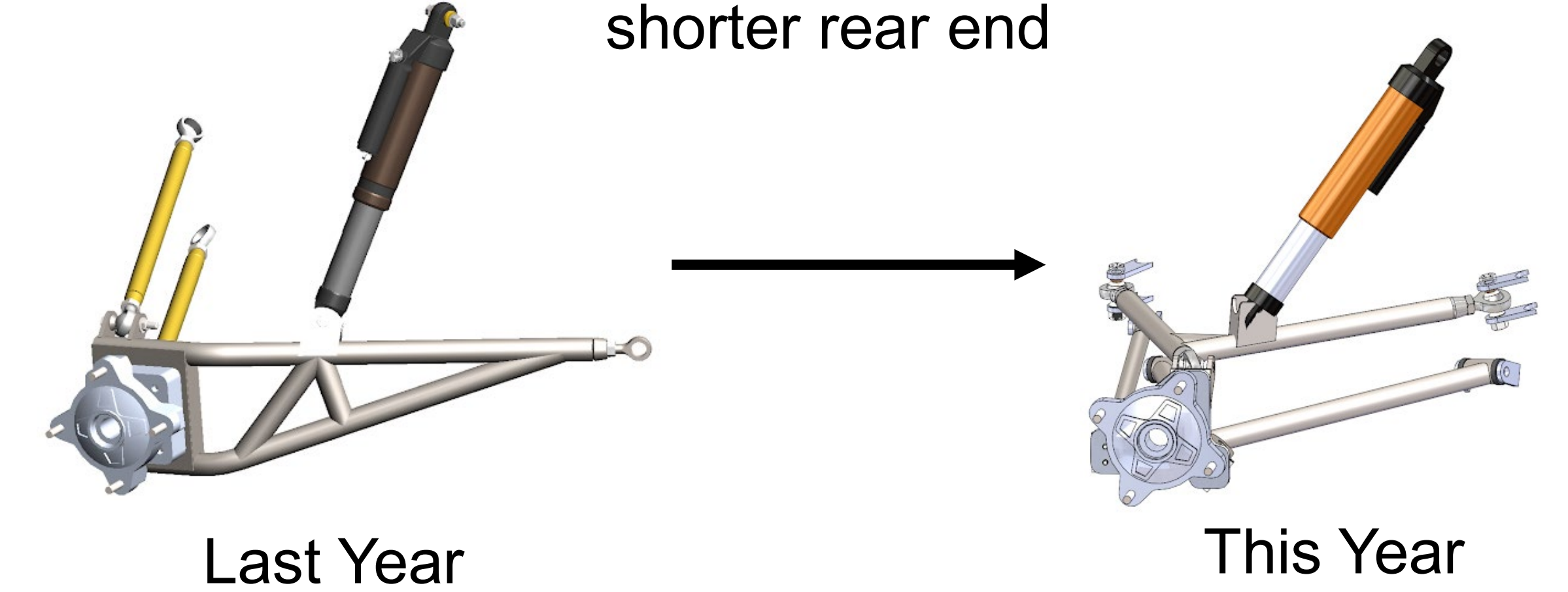
CVTech CVT transmission to maximize engine speed

Custom 3:1 transfer case to optimize top speed and torque

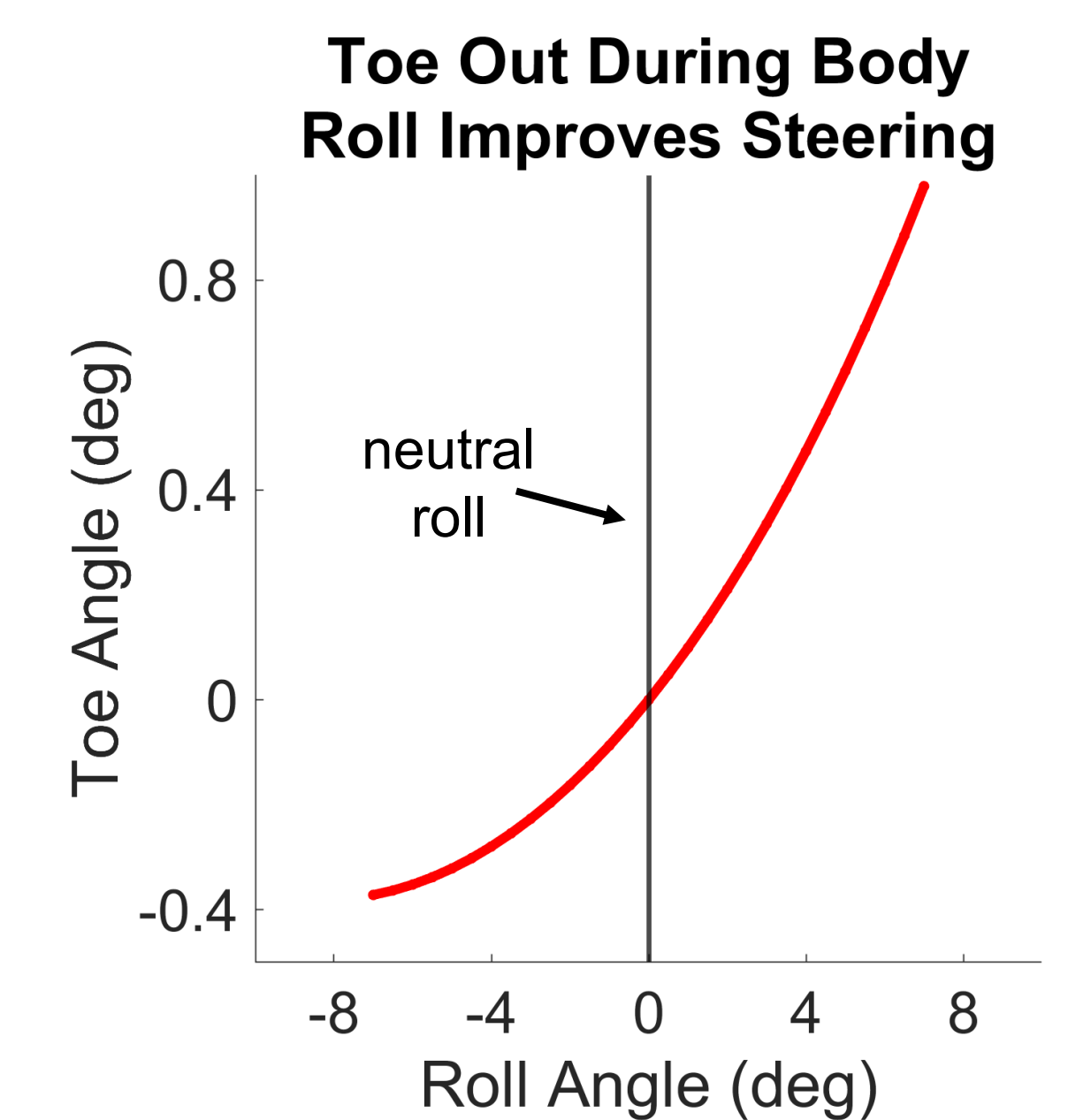
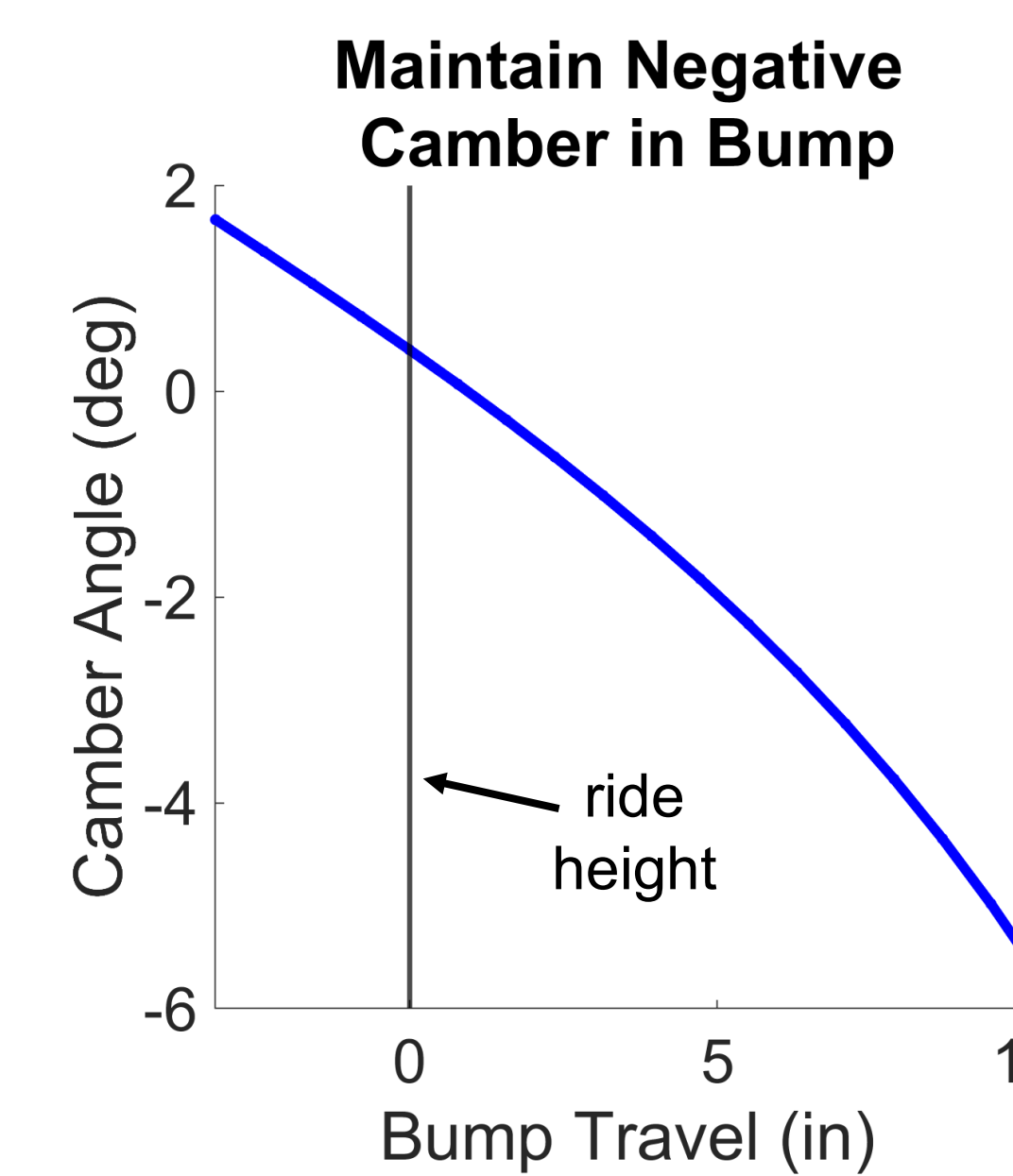


Suspension

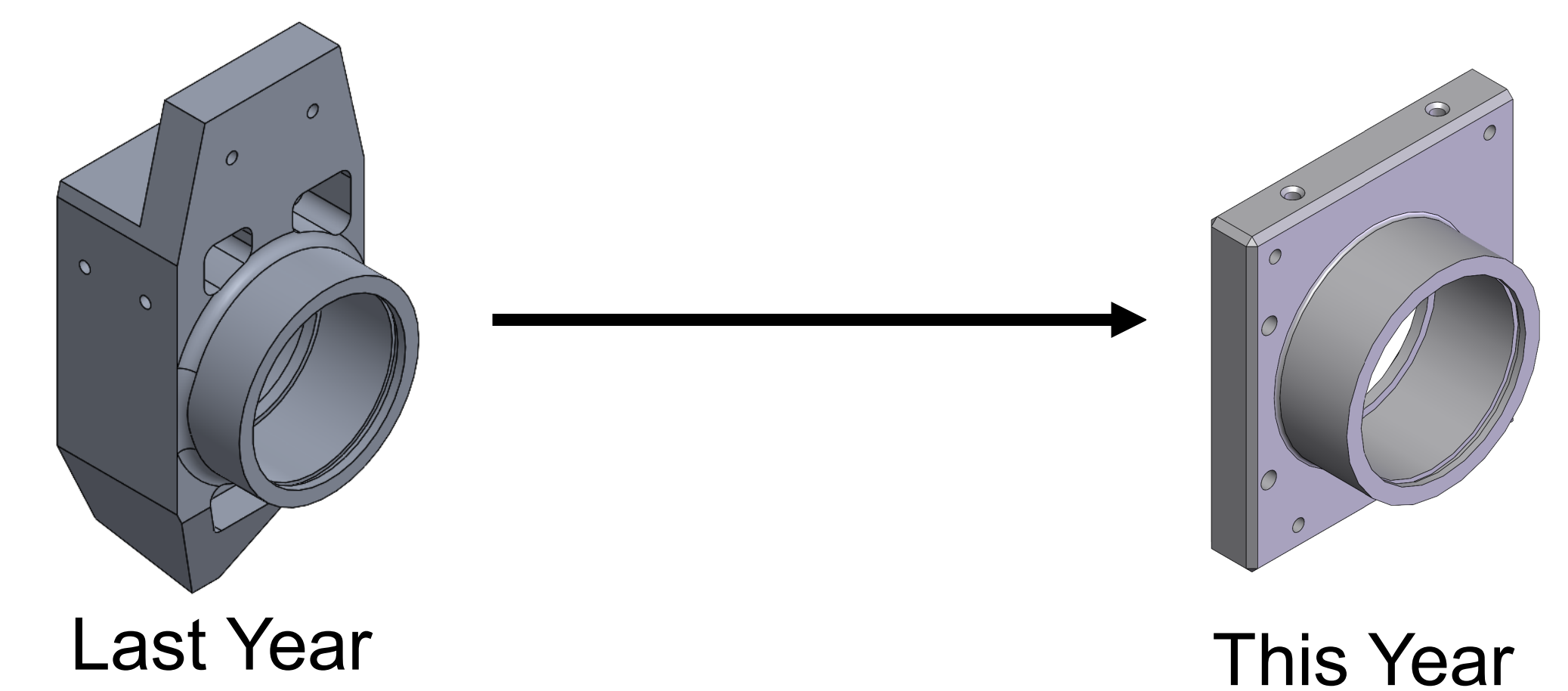
Trailing arm → A-Arm rear suspension design reduces weight by 7 lbs. and allows for improved packaging in shorter rear end



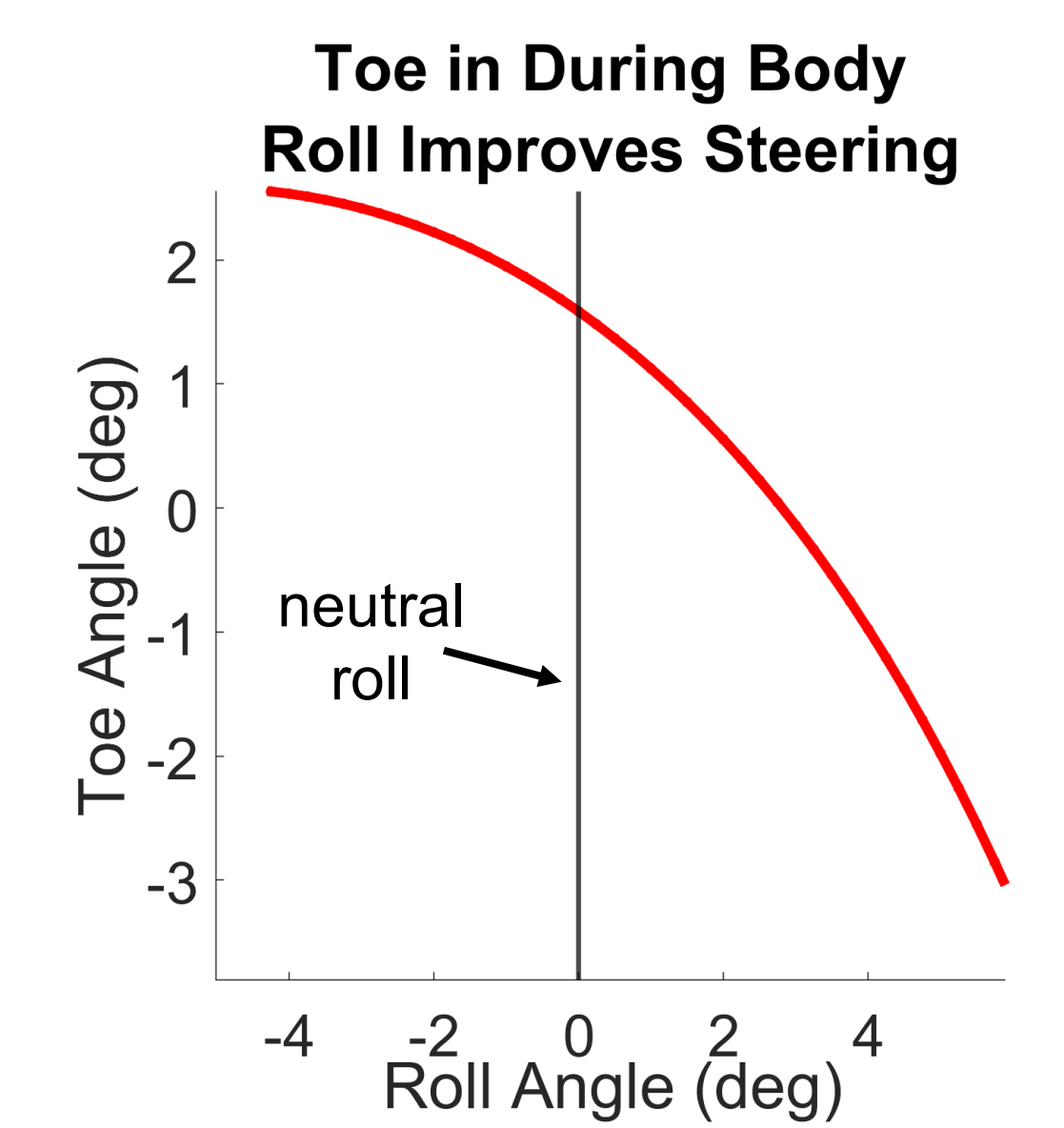
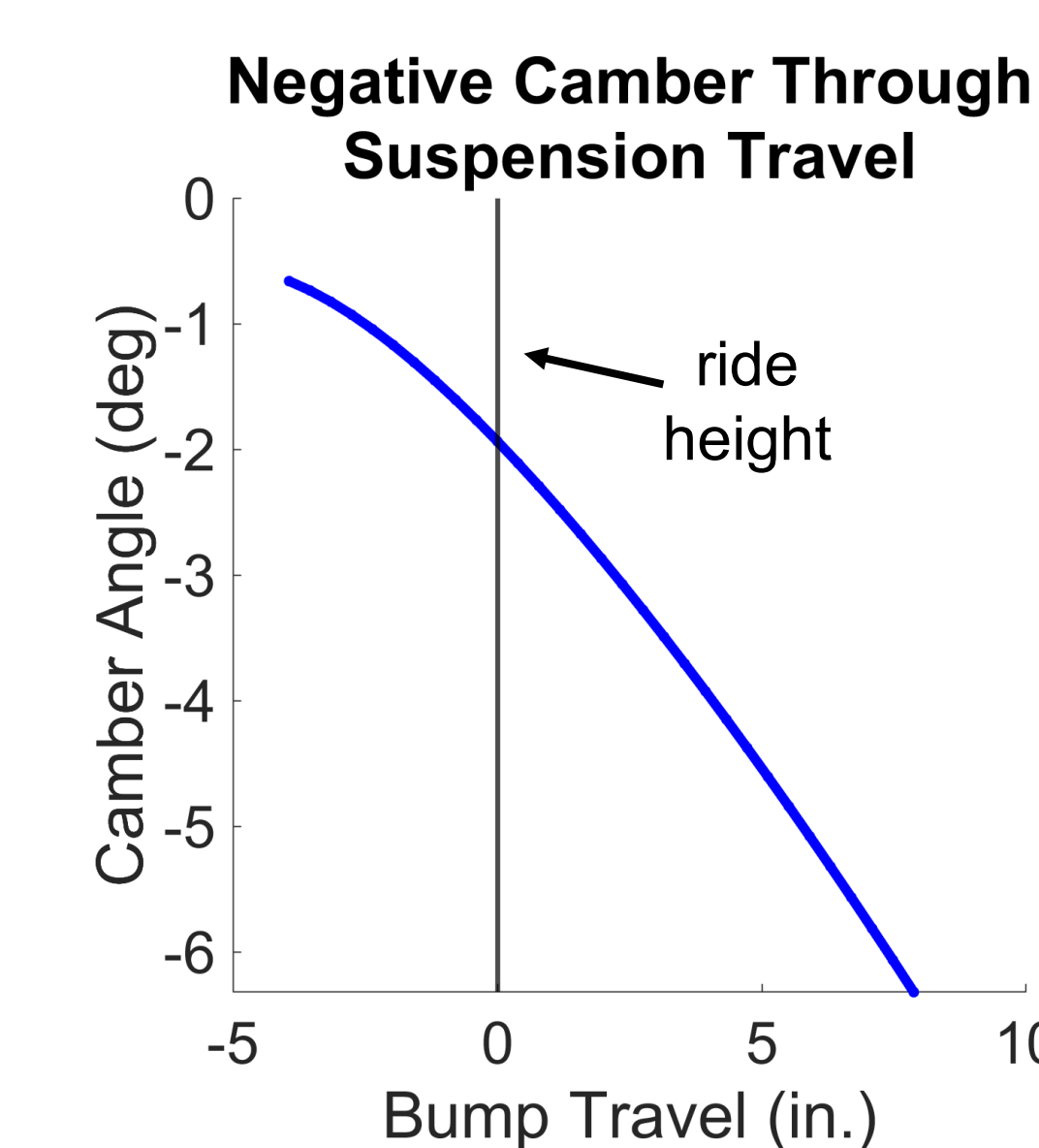
Rear Suspension Kinematics



Front upright redesign reduces weight and manufacturing time

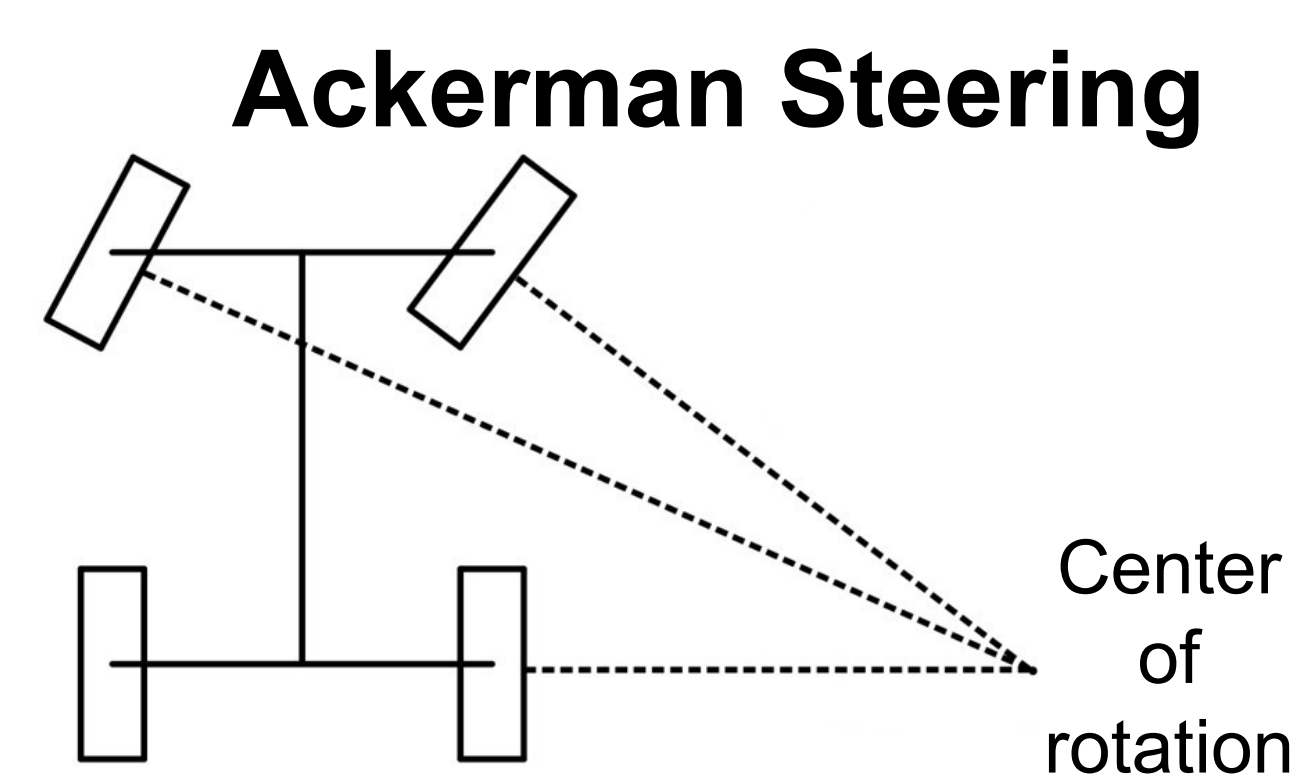


Front Suspension Kinematics



Controls

- Ackerman: inside wheel turns tighter (39° max) than outside wheel (37° max); decreases tire scrub: beneficial for low HP engine
- Lock all four wheels under braking
- Reduced packaging size to remove 4 chassis members
- Subsystem weight decreased by 4 lbs (8% reduction)



Testing Results

- Vehicle Weight: 503 lbs (without body panels)
- Front Suspension travel: 11 in
- Rear Suspension travel: 9.5 in
- Static Ride Height: 9.5 in
- Top Speed: 19 mph