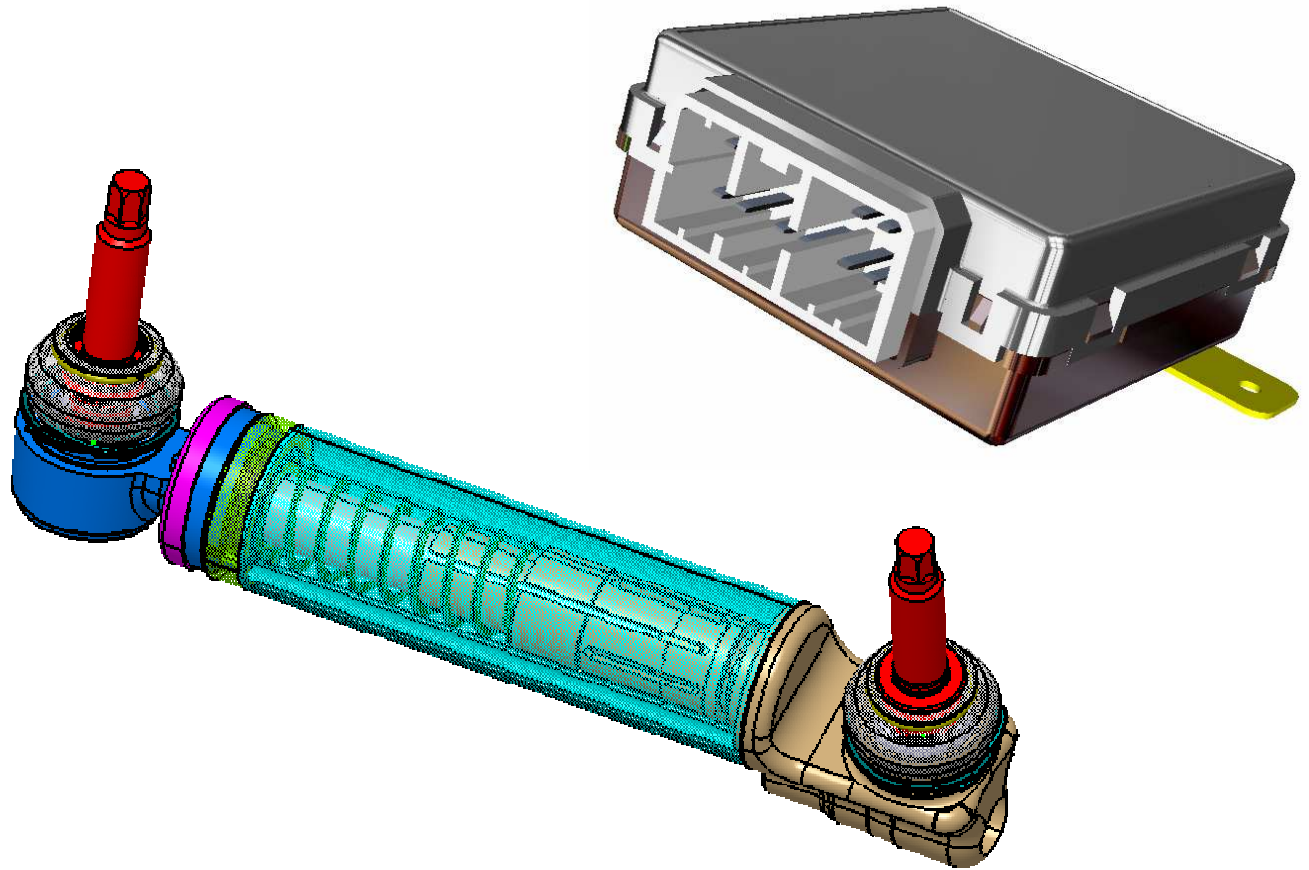




# TRW SARC System



May 7th, 2007

*safety.*

# SARC – Why are such systems needed ?



## •Ride

- Limitation on increasing roll stiffness from anti-roll bars because of :
  - Primary Ride – Head Toss
  - Secondary Ride – Single wheel bump impacts.

## •Handling

- Limitation on reducing roll stiffness from anti-roll bars because of :
  - Increased roll angles
  - Reduced handling response

## •Safety

- Limitation on reducing roll stiffness from anti-roll bars because of :
  - Propensity for roll over increased for high cg vehicles.

## •Off Road

- Limitation on increasing roll stiffness from anti-roll bars because of :
  - Reduced axle articulation reduces off road ability.



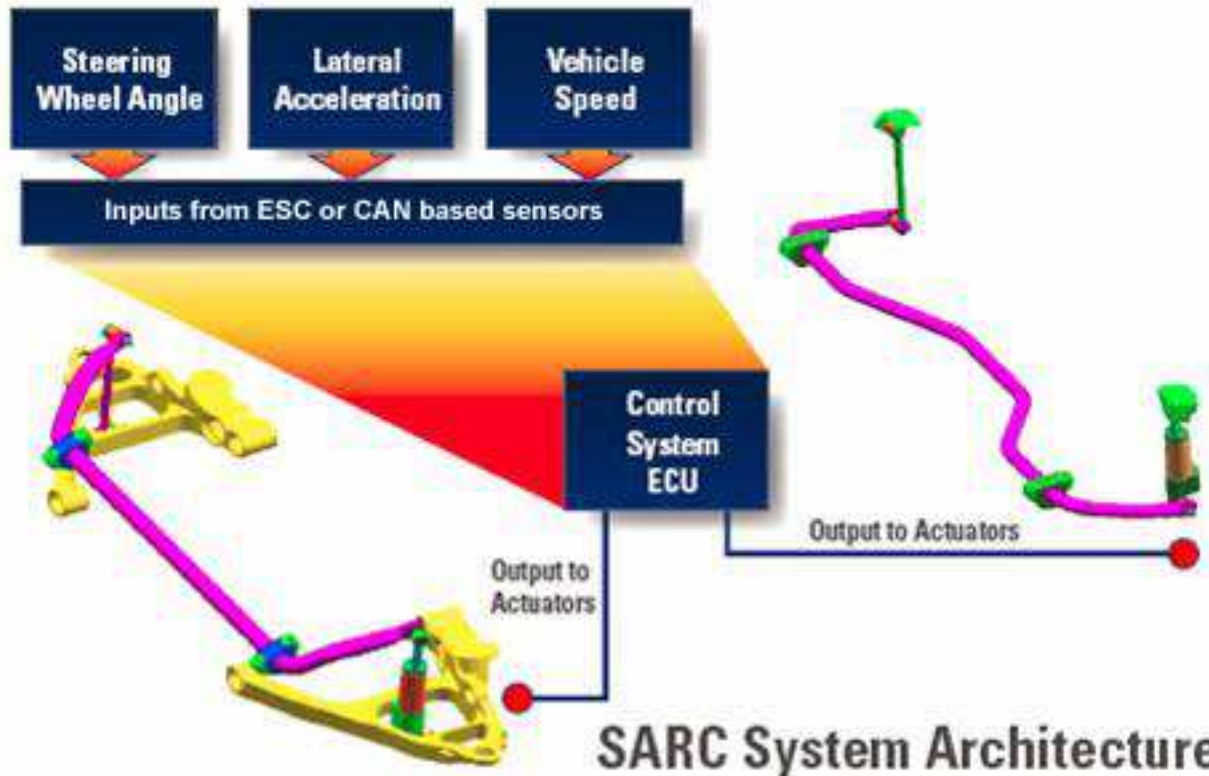
## Past Solutions

- 1980 – Lotus Active.
- Citroen Xantia
- Landrover Discovery.
- Daimler ABC system.
- BMW 5 series etc.
- Porsche Cayenne
- Dodge Powerwagon
- Porsche Cayenne
- Lexus GX470

**2010 – TRW SARC – Lowest cost simple system**



# SARC – System Architecture



Dynamically locks & unlocks vehicle stabilizer bars, based upon vehicle dynamics and driver inputs

TRW's SARC system offers the following features:

- Simple and low cost design (eliminates pumps and pipes)
- Uses existing production valve technology, seals and surface finishes
- Low power requirements.
- Self contained & sealed actuators – single 2 core wire to actuator.



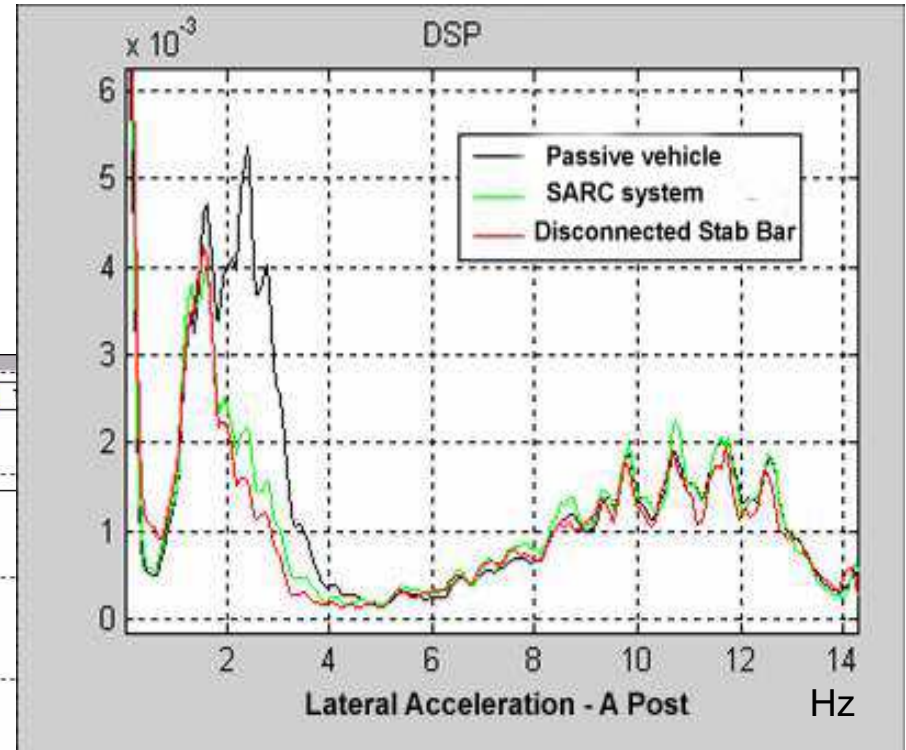
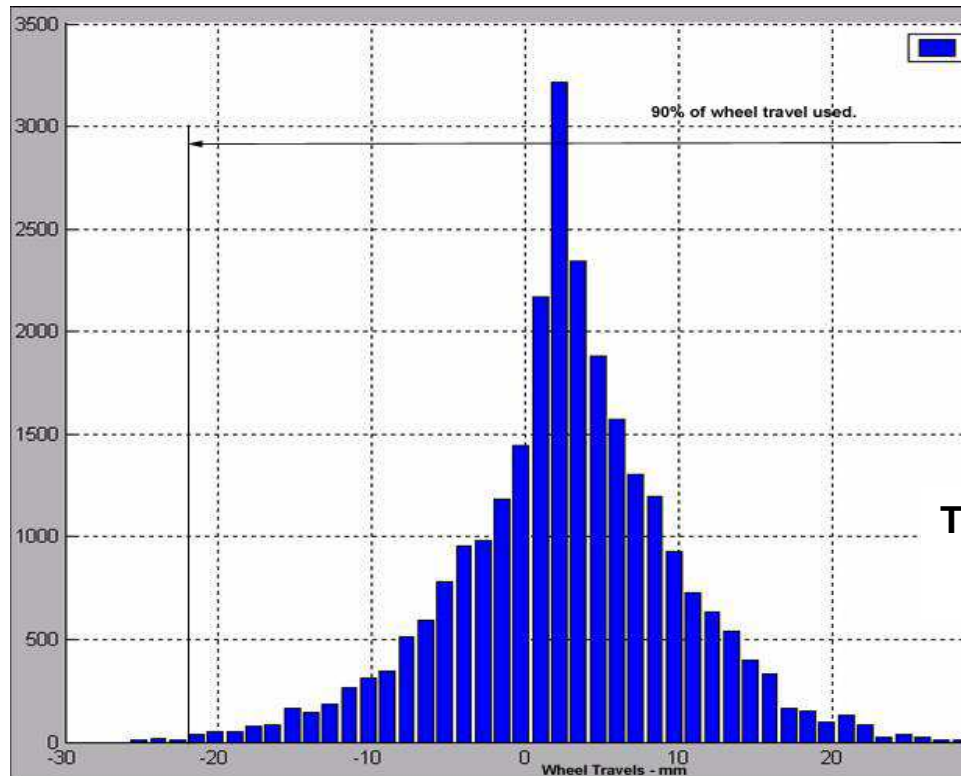
# SARC - Vehicle Benefits – Ride



## Significant ride and handling improvements

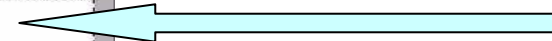
### •Ride

- Head toss reduced by eliminating anti-roll bar effects.
- Single wheel impact performance improved.



Typical wheel travels required to achieve benefits

30-50mm at Road Wheel

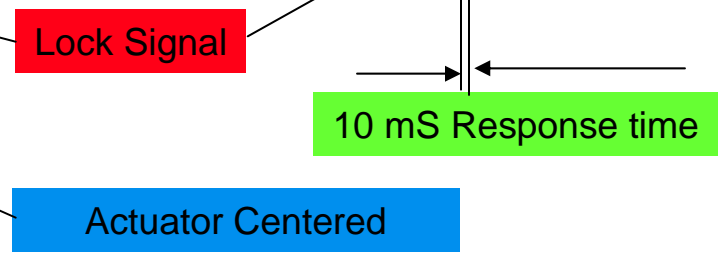
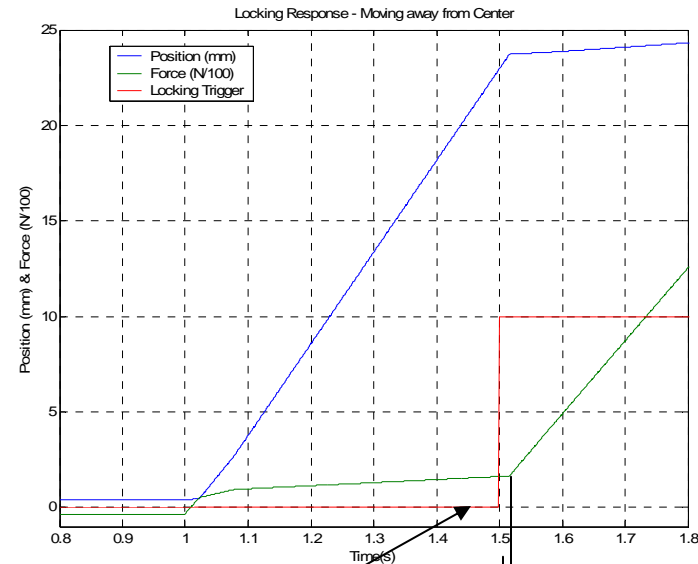
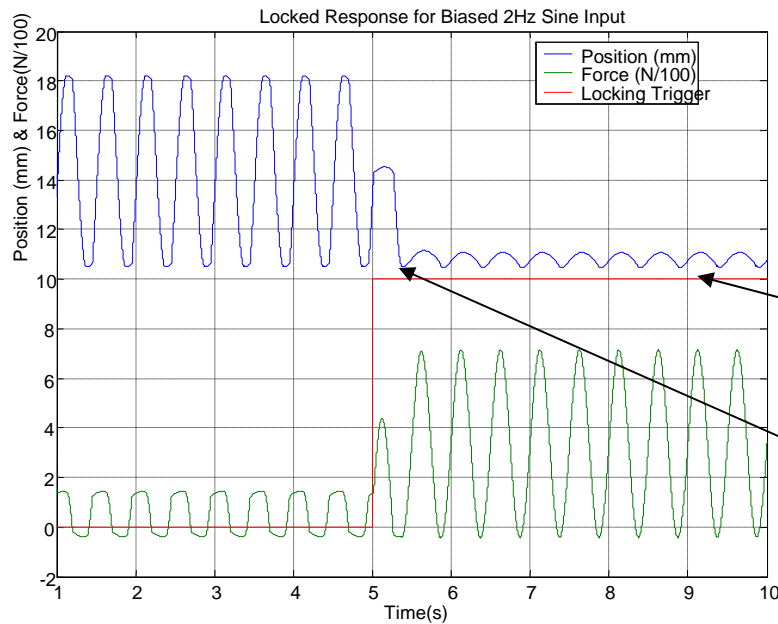


# SARC - Vehicle Benefits - Handling



## Handling ( using stiffer bars)

- Improved handling.
- Improved steering on center.
- Body roll reduced.



**Allows stiffer than standard stabilizer bars with no impact on vehicle ride performance & with improved roll resistance & handling**



# SARC - Vehicle Benefits - Safety



- Safety (using stiffer bars)

- Rollover resistance increased.



Without SARC



With SARC

NHTSA Road Edge Recovery test using robotic steering system

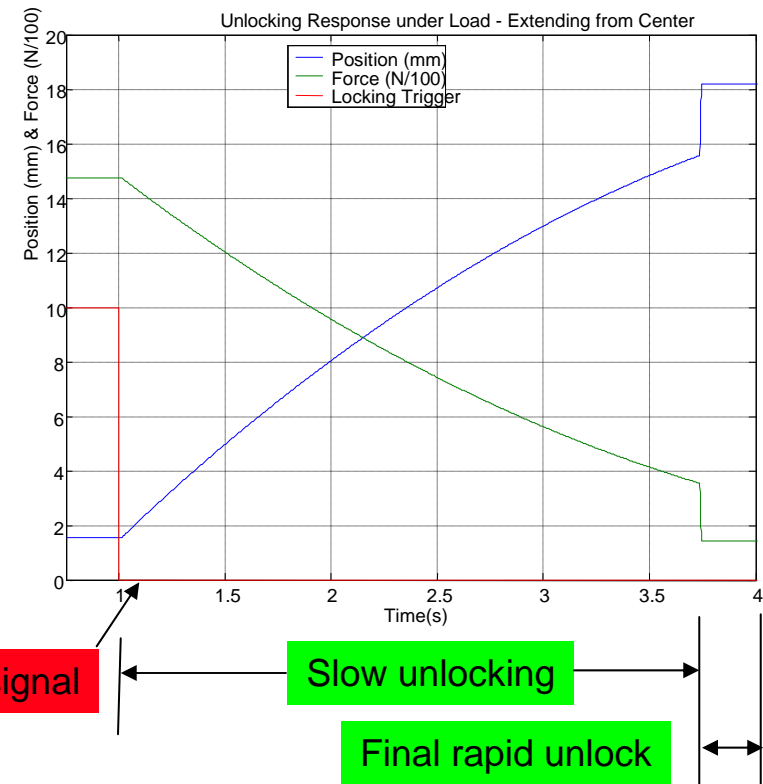
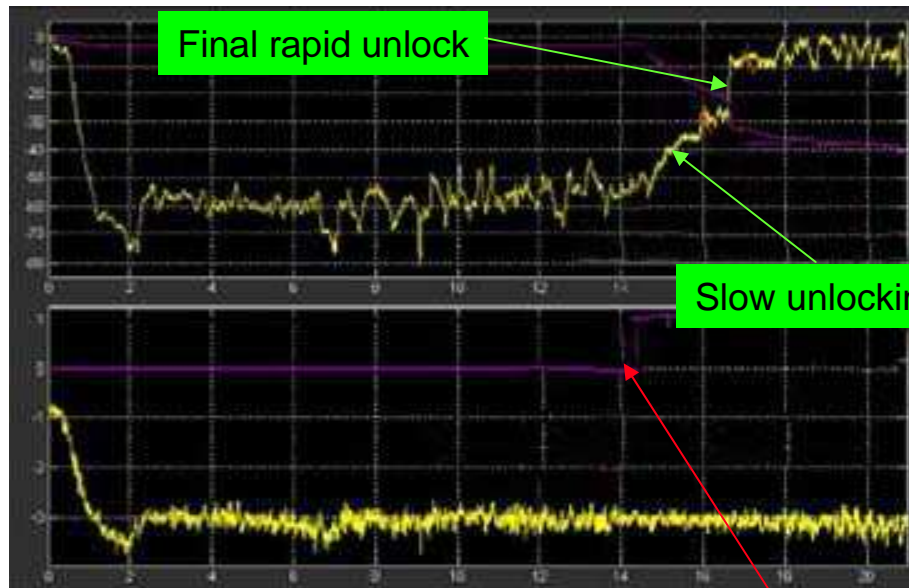


# SARC – Safety Features – soft unlock



## Unlocking Under load

- Actuator is unable to unlock rapidly when load is applied ie when cornering – soft unlock feature bleeds load off slowly.



# SARC - Vehicle Benefits – Off Road



## Enhanced off-road performance

Improved RTI using 1x, 2x or 4 actuators.

- Typically 80% of 'no bars' values achievable with a 2 actuator system.

Automatic 'normal' operation above pre-set speed.

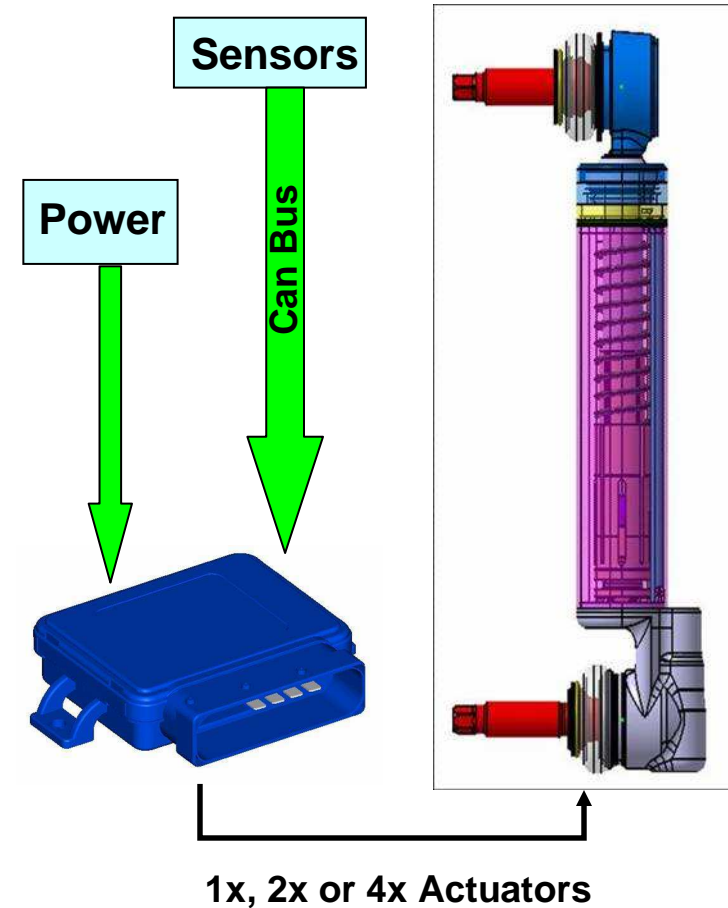
- System resumes highway settings above a preset speed with no driver intervention or wait time.

External signaling 'off road' from vehicle controllers.

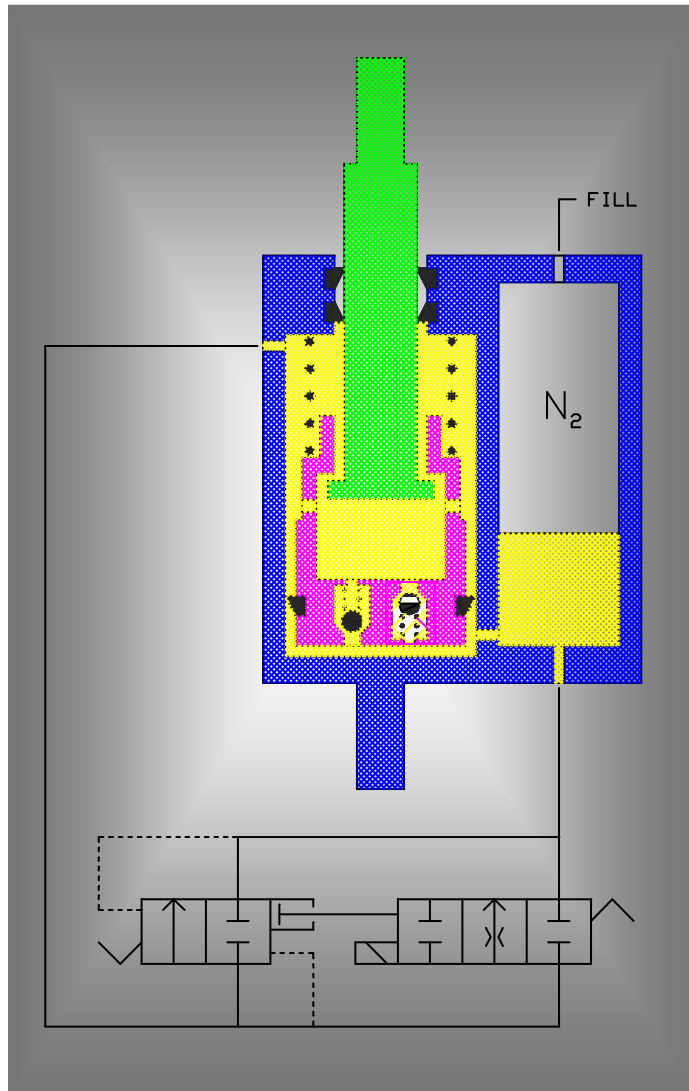
## Improved traction

Stabilizer bar disconnection in low traction

External "low traction" signal from vehicle TCS



# SARC Operation – Concept Schematic



## Operation - Unlocked

- Actuator able to move freely in extension or compression with minimal damping.
- Compression - Green piston rod moves in displacing fluid through the main orifice of the control valve into the low pressure accumulator.
- Extension - Green rod picks up floating magenta piston, and displaces into the low pressure accumulator.

## Operation - Locked.

- Check valve in free piston always allows fluid from accumulator into cylinder strut, actuator rapidly moves to center driven by road inputs. Only travel to center position is possible. Actuator can support load in the opposite direction.
- Once in center position actuator is locked in both directions.



# SARC – Summary



## Design :

Simple and low cost design (eliminates pumps and pipes)

Self contained & sealed actuators – single 2 core wire to actuator

## •Vehicle

•Ride – Improved ride reducing head toss and secondary comfort..

•Handling – Improved handling with reduced roll angles and improved vehicle response.

•Safety – Reduced roll over propensity for high cg vehicles.

•Off Road – Increased axle articulation giving improved off road and traction performance

