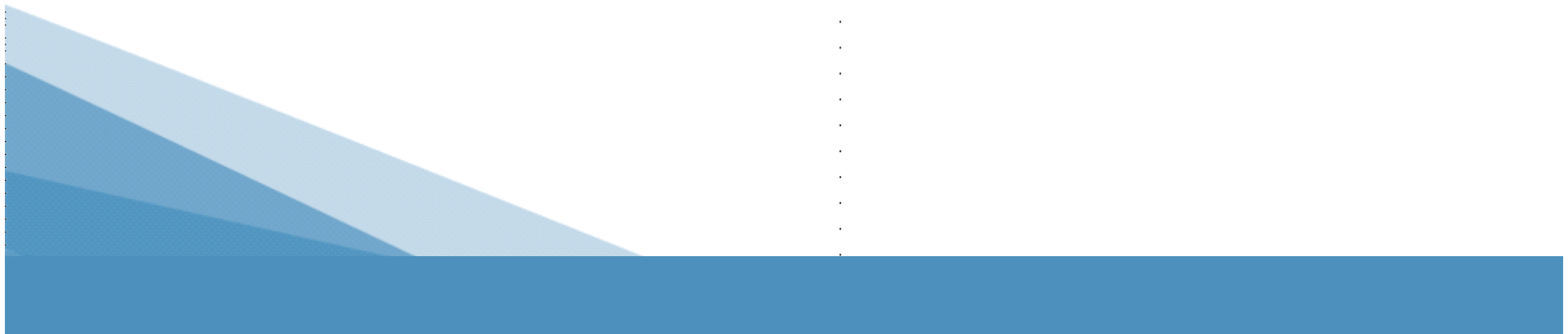


Vehicle Stability Enhancement Through Active Roll Control

Ed Wettlaufer
Altair Engineering



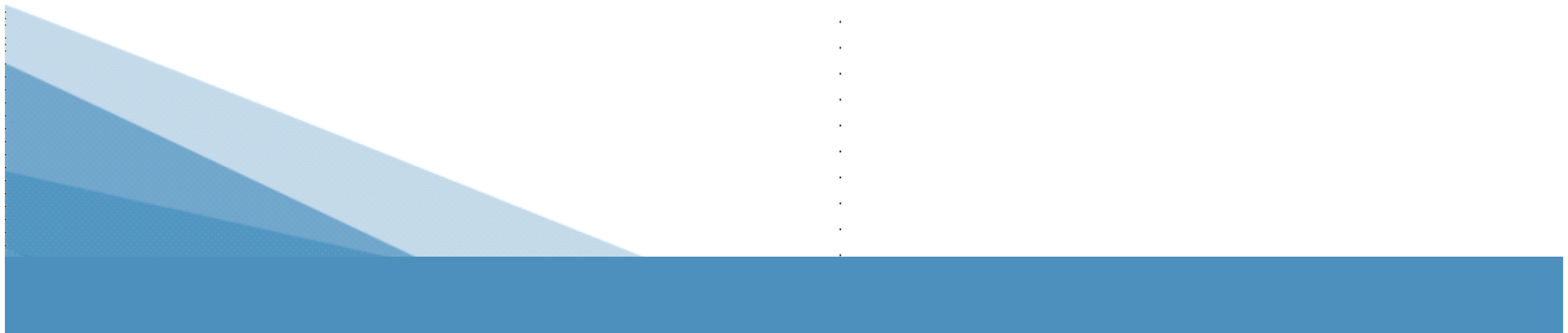
What is Stability?



Subjective - *Objective*

Drivers
Perception

Understeer
Steering Sensitivity



“Understeer”

Who are the culprits?

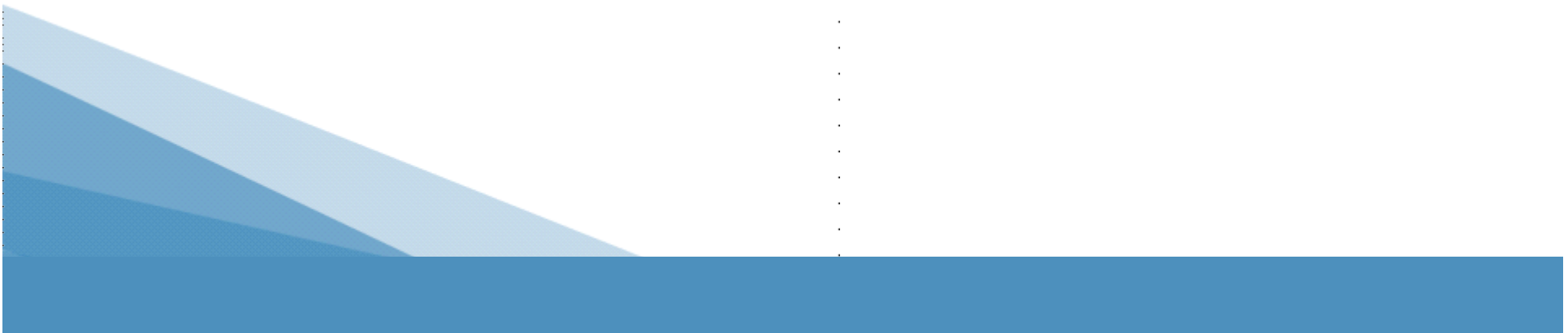
Vehicle Mass/MOI/CoG

Kinematics

Dynamics

Compliance

Tires



Understeer Allocation

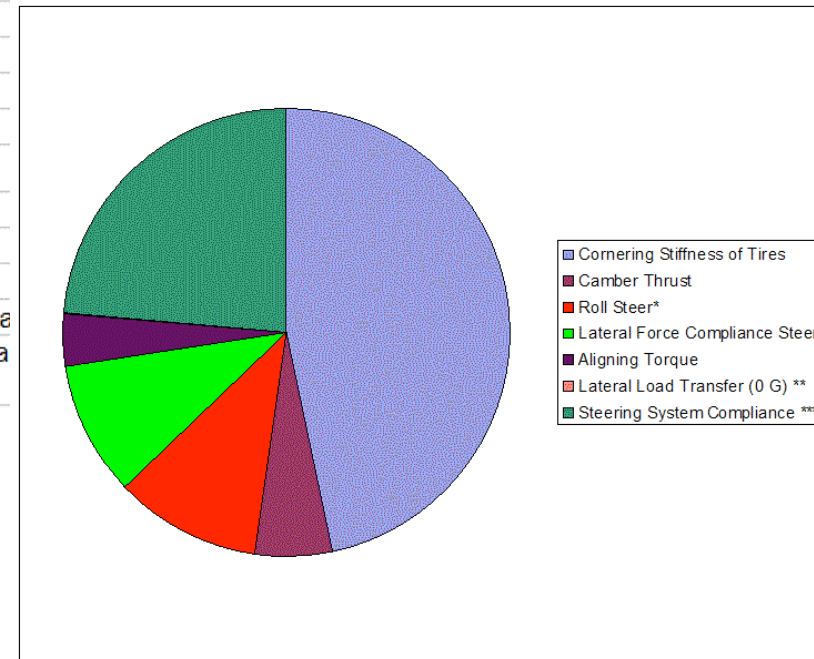
SS US Calculations -- MID SUV, on center		
	FRONT	REAR
Cornering Stiffness of Tires	4.16	-4.08
Camber Thrust	-0.01	0.00
Roll Steer*	-0.95	0.19
Lateral Force Compliance Steer	0.88	0.11
Aligning Torque	0.11	0.11
Lateral Load Transfer (0 G)**	0.00	0.00
Steering System Compliance ***	5.01	0.00
TOTAL	9.20	-3.67
		5.53

* Measured Toe vs roll curve is suspect

** Lateral Load transfer causes 0.34 deg/G of understeer at 0.5G

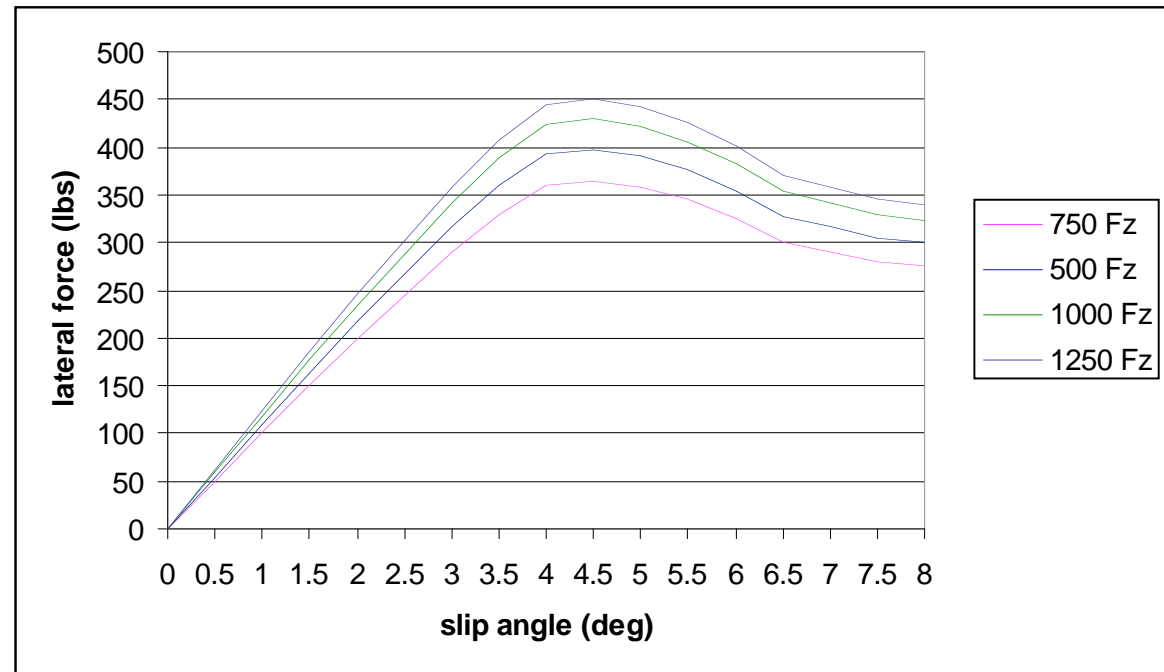
*** Steering System Compliance Measured with Engine On and Vehicle Travelling at

**** Tire saturation causes understeer to climb rapidly at lateral accels past 0.5G, as understeer approaches infinity at 0.65G

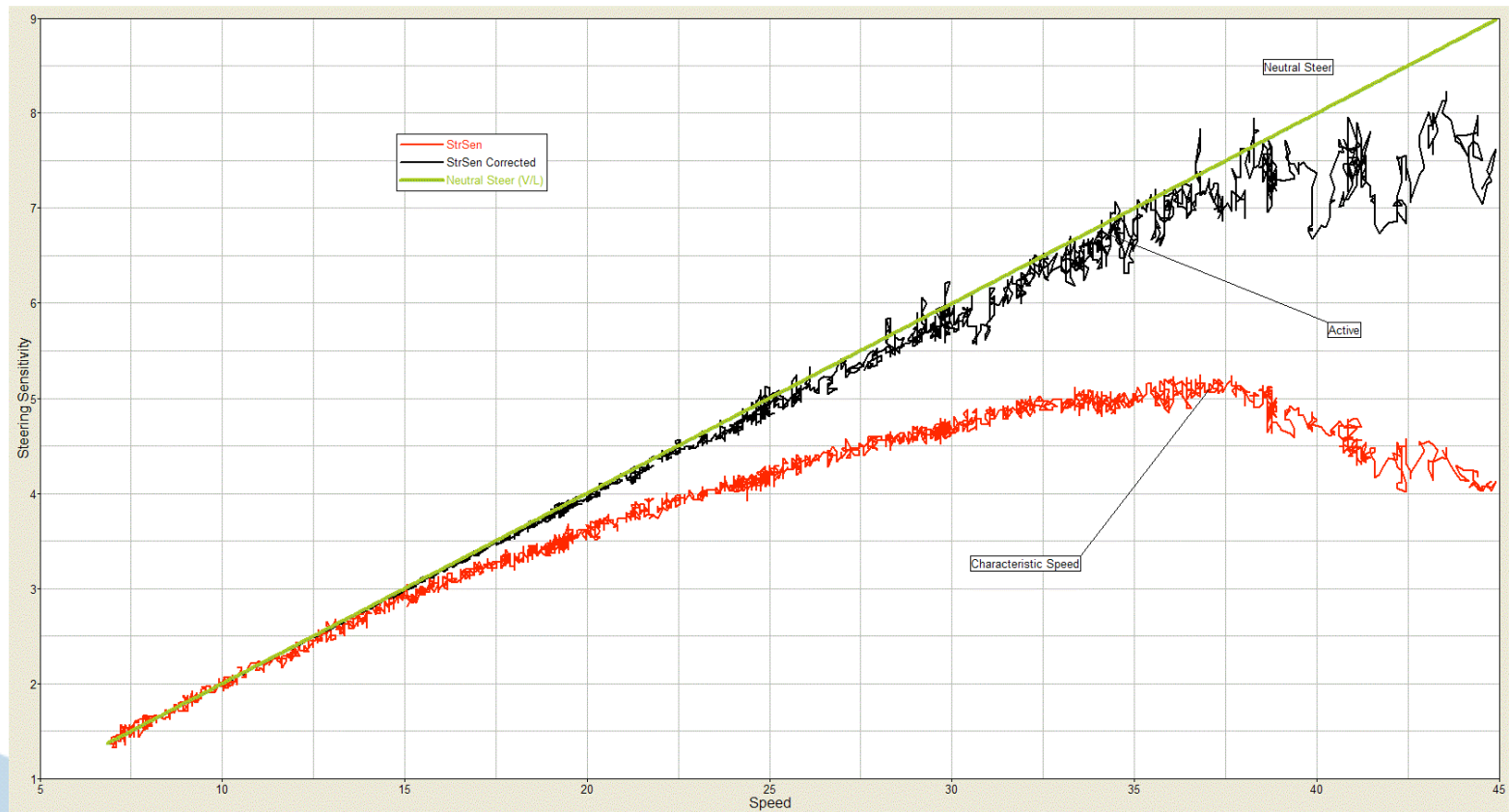


Tire Allocation

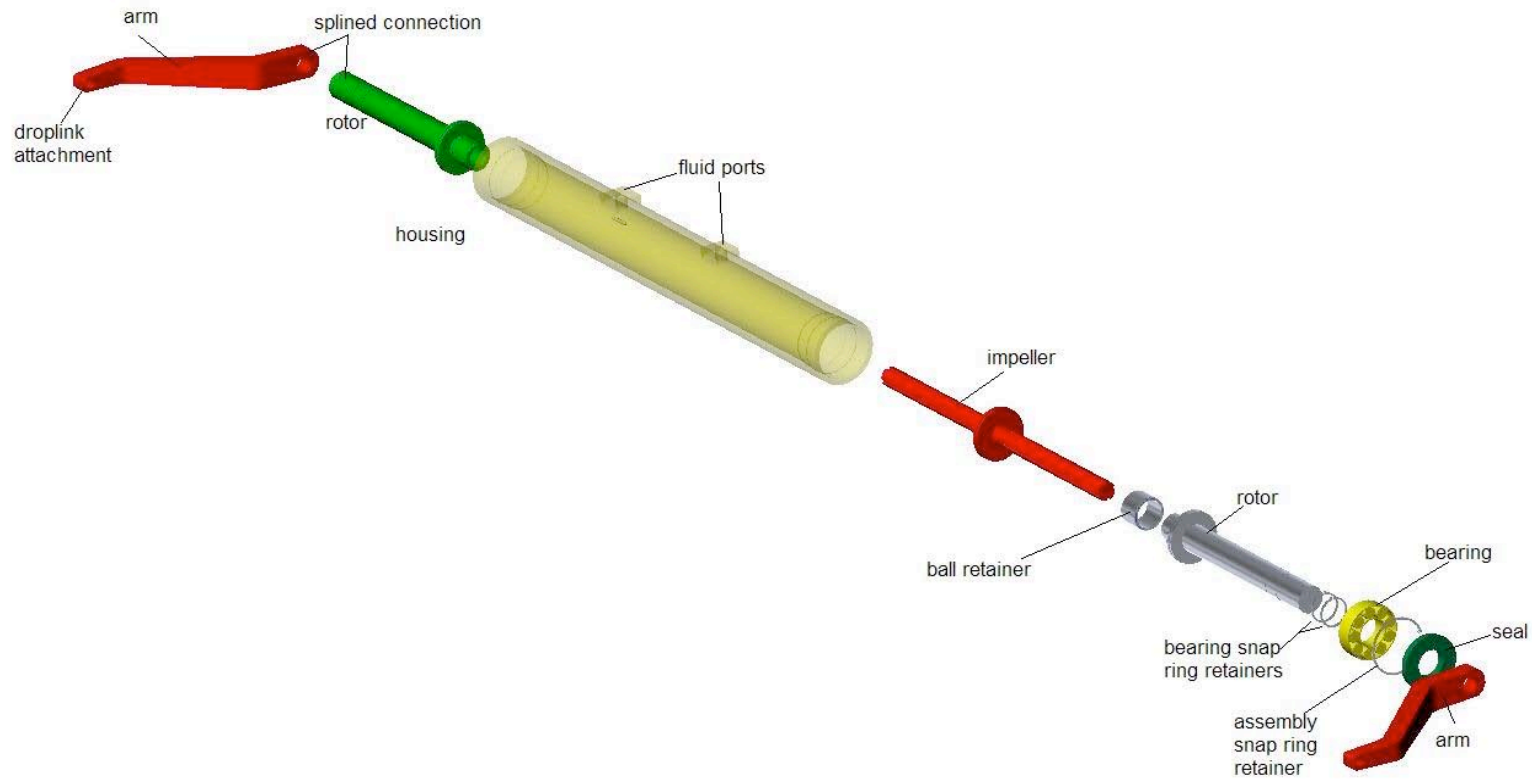
- Tires exhibit lateral force sensitivity to normal load
- Lateral weight transfer plays a role in tire transient normal loads
- The stabilizer bar alters the manner in which the vehicle manages its weight transfer



Subjective Stability and Steering Sensitivity

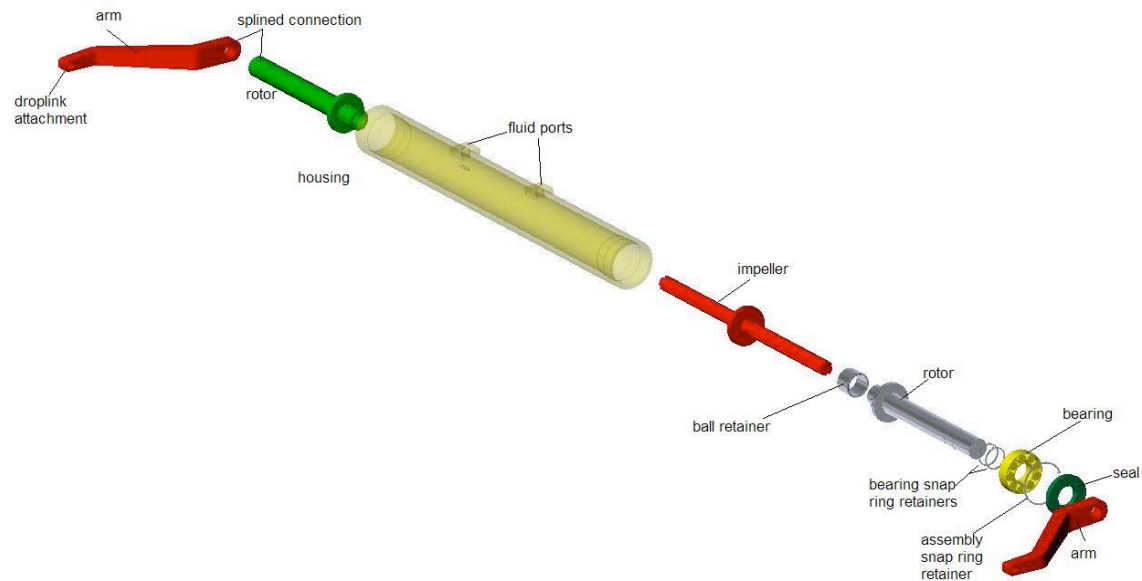


Active Stabilizer Bar



Operation

- Fixed static rate
- Variable dynamic rate
- On board hydraulic power
- Integrated controls



Effects

- ***On Highway***

- Improved on center feel
- Enhanced straight ahead stability
- Forward seeing steering condition
- Enhanced understeer/sensitivity control
- Enhanced control for recovery and overshoot

- ***Off Highway***

- Effective roll decoupling of wheels
 - Improved mobility
- Enhanced stability – single wheeled inputs

Advantages

- Many COTS components
- Hydraulic power provided by power steering or similar pump
- Scale-able design for various platforms
- Non-invasive operation
- Controls integrated with current on vehicle systems

Discussion

