

19th 2005
ESV

*19th International Technical Conference
on the Enhanced Safety of Vehicles*

USA

An Overview of NHTSA's 2005 ESC Research Program



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Presentation Overview

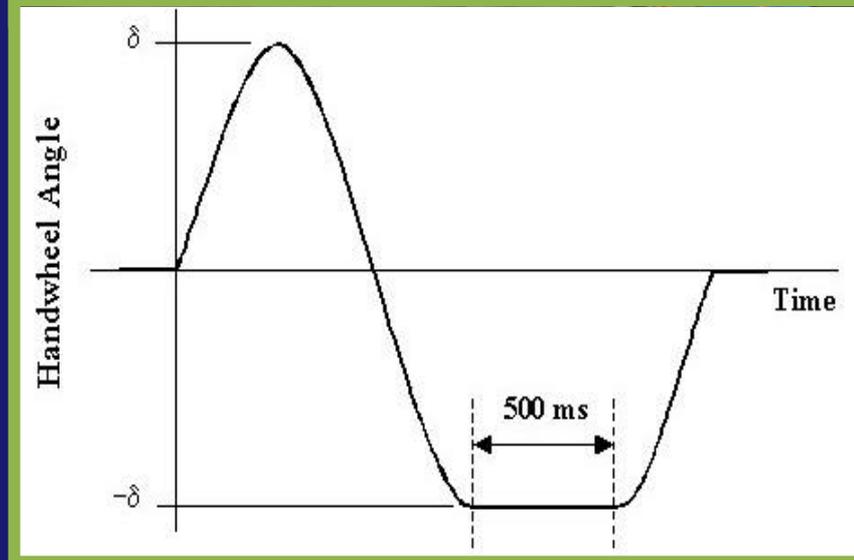
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- ❖ Program Objectives
- ❖ ESC Effectiveness Criteria
- ❖ Government and Industry Collaboration
- ❖ Final Maneuver Selection
- ❖ Upcoming Research
- ❖ Conclusions
- ❖ Sources for Additional Information

- ❖ Validate and refine NHTSA's proposed ESC effectiveness criteria
- ❖ Work with industry to collaboratively gather test data

- ❖ A vehicle with an effective ESC should:
 - Not spinout
(lateral stability measure)
 - Be able to achieve a minimum lateral displacement
(responsiveness measure)
 - Not produce two-wheel lift
 - Not produce rim-to-pavement contact or tire debonding
- ❖ These criteria must be satisfied during a maneuver specially designed to excite yaw instability

- ❖ Performed with a steering machine
- ❖ Slowly Increasing Steer (*for characterization use only*)
- ❖ 0.7 Hz Sine with Dwell
- ❖ 0.7 Hz Increasing Amplitude Sine
- ❖ 500 deg/s Yaw Acceleration Steering Reversal
- ❖ 500 deg/s Yaw Acceleration Steering Reversal w/Pause



- ❖ Maneuver severity increased with steering wheel angle
- ❖ ESC enabled and disabled
- ❖ Dry, high-mu asphalt test surface
- ❖ Nominal load
 - Driver
 - Instrumentation
 - Outriggers if vehicle is an SUV, pickup, van, minivan, station wagon, or crossover vehicle
- ❖ Tires of original equipment specification and placard-recommended inflation pressures

What is a “Spinout”

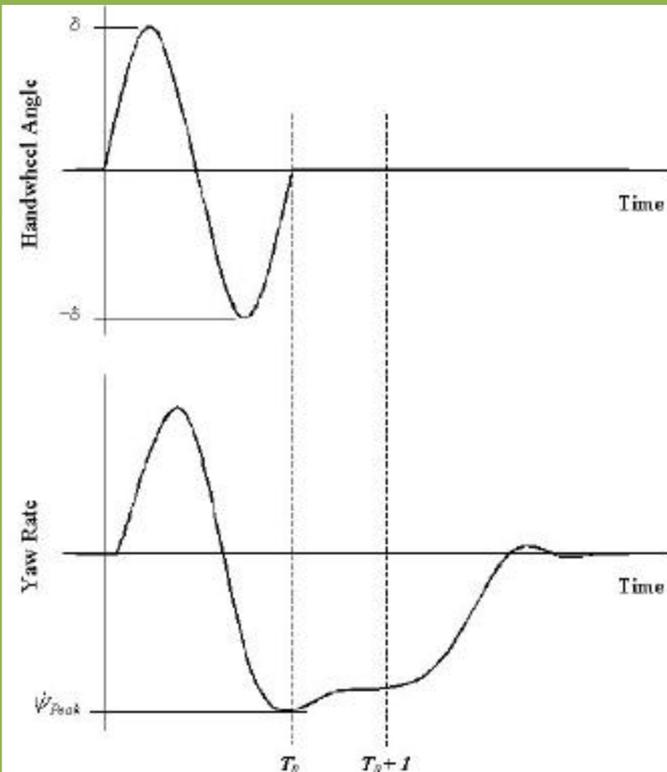
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Preliminary Definition:

$$\text{Percent } \dot{y}_{Peak} = 100 * \left(\frac{\dot{y}(t)}{\dot{y}_{Peak}} \right)$$

Set $t = t_0 + 1$

Spinout occurs if $\text{Percent } \dot{y}_{Peak} \geq 60\%$



“Spinout” Threshold Example

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0.6 Hz Sine Steer, SWA = 300 degrees



At $t_0 + 1$, Percent $\dot{y}_{Peak} = 60.6$

0.7 Hz Sine with Dwell

2004 Volvo XC 90
ESC Disabled
SWA = 120 degrees

At $t_0 + 1$, $\text{Percent } \dot{y}_{Peak} = 18.9$

Threshold not exceeded

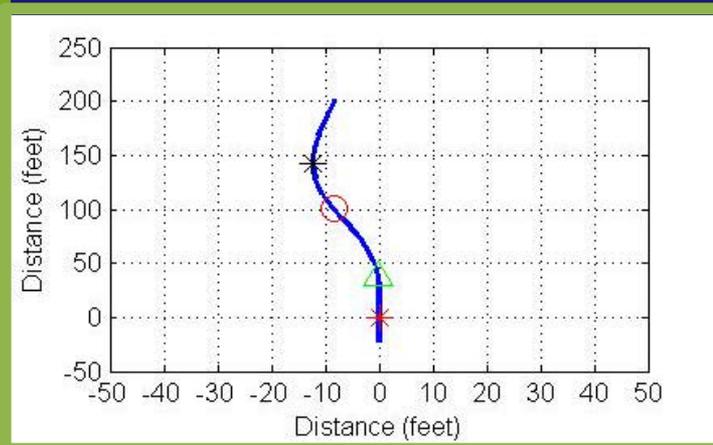
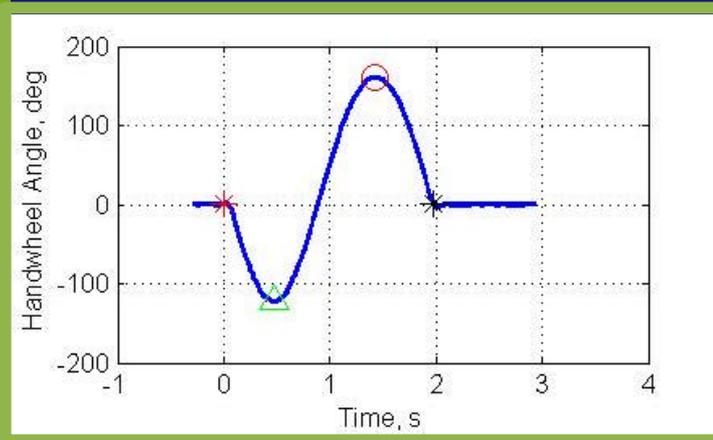
2004 Volvo XC 90
ESC Disabled
SWA = 130 degrees

At $t_0 + 1$, $\text{Percent } \dot{y}_{Peak} = 84.1$

Threshold exceeded

- ❖ An effective ESC should not impede responsiveness
 - Proposed minimum lateral displacement: 12-ft
 - Must be achieved prior to completion of a maneuver performed with the maximum steering wheel angle
 - Measured via GPS during testing
 - Referenced to pre-maneuver heading
- ❖ NHTSA's evaluation criterion will not penalize vehicles equipped with rollover mitigation technology

0.6 Hz Increasing Amplitude Sine



**2004 GMC Savana
ESC Enabled
SWA = 160 degrees**

Lateral Displacement = 12.2 ft

- ❖ NHTSA hopes to collect data from 50 vehicles in 2005
 - Will confirm the best maneuver for determining whether a vehicle is equipped with an effective ESC has been selected
 - Used to improve the robustness of the spinout model
 - Will help assess the responsiveness of ESC-equipped vehicles
- ❖ A collaborative testing effort between NHTSA and industry is underway
 - Test data from industry-evaluated vehicles is critical

- ❖ The “Sine with Dwell” is NHTSA’s preferred test maneuver
- ❖ Results from NHTSA and industry indicate the maneuver offers the best combination of severity, performability, and repeatability for a broad range of vehicles

- ❖ Continued evaluation of ESC-equipped vehicles
 - A total of 50 vehicles to be evaluated in 2005
 - Test output repeatability will be studied
 - Tire wear effects will be examined
- ❖ NHTSA's lateral stability and responsiveness metrics to be finalized by July 1, 2005

- ❖ ESC research is a top priority for NHTSA
- ❖ A test maneuver capable of evaluating ESC effectiveness has been selected
- ❖ Preliminary ESC effectiveness criteria have been identified, refinement is underway
- ❖ The collaborative testing effort between NHTSA and industry has been very successful

❖ ESC Docket

- <http://dms.dot.gov/search/searchFormSimple.cfm>
- Number 19951

❖ VRTC ESC Website

- <http://www-nrd.nhtsa.dot.gov/vrtc/ca/esc.htm>

 Questions?

Thank you