



Toyota Unintended Acceleration: Learning From Crises and Moving Forward

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Background

- Safety Research & Strategies:
 - Multi-disciplined group specializing in product safety, particular expertise in motor vehicle issues.
 - Provides a wide-range of clients with fact-based information, data, context, and strategies for addressing harm caused by potentially defective products and practices.
 - Clients include attorneys, engineers, supplier companies, government.



Background

- Safety Research & Strategies:
 - Advocacy
 - Leverage our understanding of safety issues to advocate for improvements in safety and injury prevention matters.
 - Developers of VSIRC
 - Commercial database designed to provide access and tools for researching government data on motor vehicles, tires, child restraints and equipment.



Background: Toyota UA

- Examined and analyzed public data and documents for attorney clients.
 - Complaints, investigations, recalls, service documents, etc.
 - How does this information comport with factual information in a specific case?
 - What can be done to better understand potential defect issues?



Background: Toyota UA

- SRS authored three independent reports, each critically examined the public records and data.
 - ***Toyota Sudden Unintended Acceleration***, Feb. 5, 2010
 - Addendum on February 19, 2010,
 - ***Update Report: Toyota Sudden Unintended Acceleration***, Oct. 25, 2010
 - ***An Examination of the National Highway Traffic Safety Administration and the National Aeronautics and Space Administration Engineering Safety Center Assessment and Technical Evaluation of Toyota Electronic Throttle Control (ETC) Systems and Unintended Acceleration***, May 23, 2011

(Reports can be found at www.safetyresearch.net)



Background: Toyota UA

- Provided report and testimony before the House Energy and Commerce Subcommittee on Oversight and Investigations, Feb. 23, 1010, hearing on Toyota UA.
- SRS has also published a number of findings of interest on Toyota UA at <http://www.safetyresearch.net>



Background: Toyota UA

- Summary of findings:
 - Technical:
 - SUA is a complex multi-root cause problem.
 - Toyota's main defense in previous unintended acceleration investigations is false. NESC found scenarios in which engine speed can be increased, RPMs can surge, and the throttle can be opened to various degrees in contradiction to the driver's command and not set a Diagnostic Trouble Code (DTC).
 - NESC found physical evidence of one real-world cause of UA in some Toyotas.
 - Toyota should implement a brake-to-idle override on all affected models and model years. An effective brake override system may mitigate many of the SUA events, regardless of their root cause.



Background: Toyota UA

- Summary of findings:
 - Data:
 - Analysts did not use standard statistical methodologies to test scientific hypotheses about UA using the consumer complaint and warranty data.
 - The data do not support claims that media hype is responsible for generating a surge of baseless UA reports.



Background: Toyota UA

- Summary of findings:
 - Lack of transparency:
 - NHTSA has shrouded many of its processes and Toyota's submissions in secrecy.
 - Secrecy has prevented an honest assessment of the UA problem and the development of a comprehensive solution to the multitude of causes. As a result, these problems will continue to occur.



Background: Toyota UA

- Summary of findings:
 - Conflicts of interest:
 - The NHTSA personnel who accepted Toyota's explanations uncritically and cleared the automaker in past investigations continued to manage the NHTSA-NESC effort.
 - Complaints that did not fit pre-conceived theories were excluded from investigations.
 - Significant physical evidence of a real-world cause of UA was dismissed on the basis of an analysis of secret warranty data performed by Toyota's litigation defense experts Exponent – not NHTSA or NASA.



Background: Toyota UA

- Summary of findings:
 - Regulatory:
 - The agency is decades behind in regulating and investigating automotive electronics.
 - FMVSS 124 Accelerator Controls was established in 1972 for mechanical throttles. This has left the agency ill-prepared to investigate complex electronic defects in torque management systems.



NAS: Electronic Vehicle Controls and UA

- “The objective of this contract is to provide NHTSA with an independent review of past and ongoing industry and NHTSA analysis to identify possible causes of unintended acceleration (UA) and make recommendations on:
 - NHTSA research, rulemaking, and defects investigation activities and;
 - human, infrastructure, and financial resources required for NHTSA to assure the safety of Electronic Throttle Controls (ETC) and other electronic vehicle control functions.”



Defect Crises and NHTSA: Moving Forward

- The two biggest auto safety crises in the last decade:
 - Firestone tire tread separation / Ford Explorer rollovers
 - Toyota Unintended Acceleration
- Parallels between these two issues are useful to examine and can serve as a roadmap for moving forward.



Defect Crises and NHTSA: Firestone/Ford Case Study

- The most popular and best-selling SUV, the Ford Explorer, equipped with their OE Firestone tires, was prone to rollovers after tread separations, causing significant numbers of deaths and injuries.
- The Firestone Radial ATX and Wilderness tires met all of the federal regulations at the time.
- The standards applied to tires were developed in an era when bias-ply tires were the norm and radial tires were just emerging.



Defect Crises and NHTSA: Firestone/Ford Case Study

- There were no federal standards for occupant protection in rollovers. (FMVSS 216 – Roof strength was a “temporary” standard promulgated in 1972 that required nominal static roof strength in place of dynamic rollover testing.)
- There was no minimum stability standard for SUVs, a new breed of station wagon with a high-center of gravity based on truck platforms.
- Industry fought off any regulations, even as the rollover death tolls in light trucks rose to epidemic levels.
 - Rollovers accounted for 8 percent of light vehicle crashes, but accounted for 31 percent of all occupant fatalities. (*Initiatives to Address the Mitigation of Vehicle Rollover*, NHTSA, June 2003)



Defect Crises and NHTSA: Firestone/Ford Case Study

- A series of gruesome high-profile crashes and resulting news stories about the safety of Ford Explorers and Firestone tires compelled NHTSA to begin investigating.
- After Ford's overseas tire recalls came to light, the automaker launched a series of campaigns to replace the same Firestone tires on U.S. models.
- Ford insisted that the tires bore all the blame.
- NHTSA investigation of the Explorer found no reasons to attribute America's then-best selling SUV in these tire-related fatal crashes.

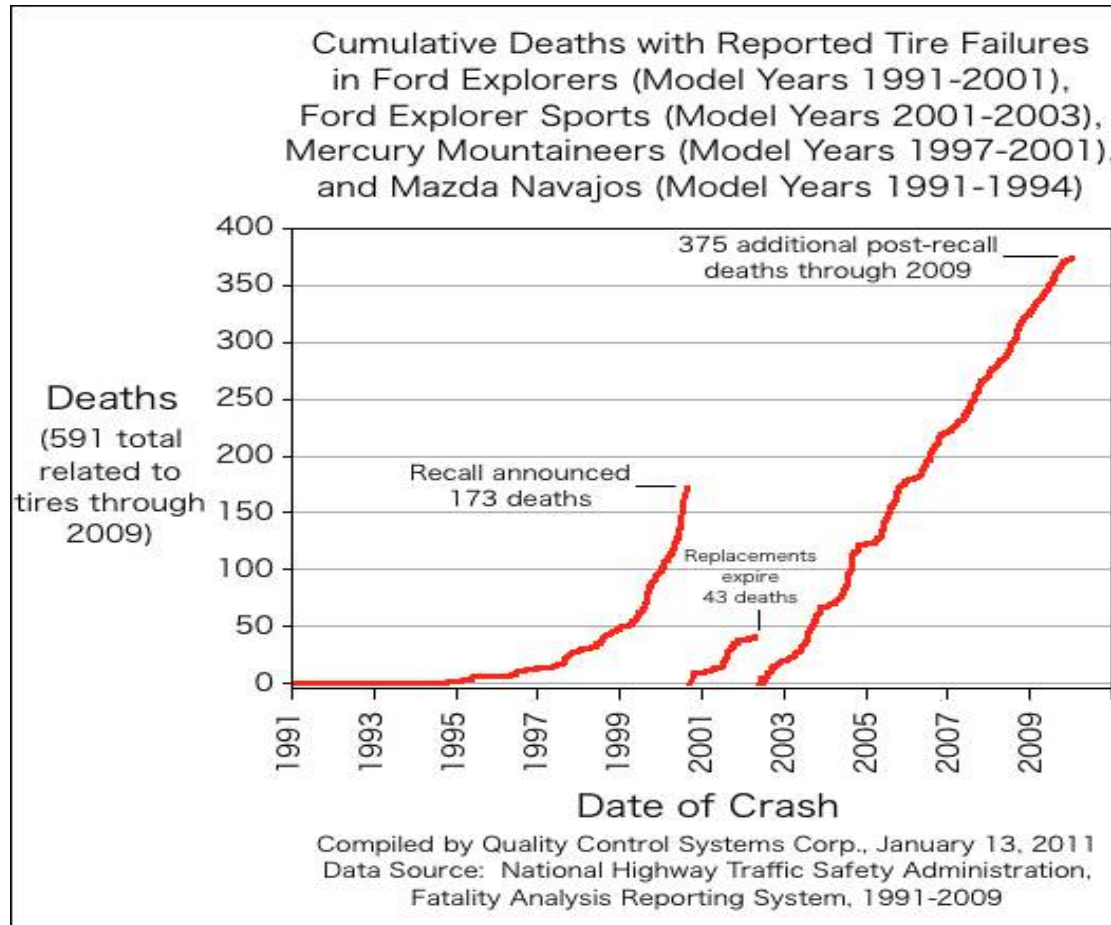


Defect Crises and NHTSA: Firestone/Ford Case Study

- But the problem appears to be more complex than defective tires.
 - After all the recalls for defective tires were announced, Explorer tire-related rollover deaths abated temporarily, but then began to increase. A secret investigation of the additional deaths did not result in any further action by the agency.
 - Independent analyses of crash data shows that the recalls and replacement campaigns by Ford and Bridgestone/Firestone did not achieve long-term effectiveness in eliminating tire-related deaths in the Ford Explorer fleet.



Defect Crises and NHTSA: Firestone/Ford Case Study



http://quality-control.us/explorer_tire_fatalities.html



Defect Crises and NHTSA: Firestone/Ford Case Study

- Analysis of crash data also shows Ford Explorer vehicles are standouts among their peers with regard to occupant (*NHTSA's Secret Data and Ford Explorers in Fatal, Post-recall, Tire-related Crashes, Quality Control Systems, 2006*).
- If the tires were the only problem, what explains the post-recall death toll and significantly higher Explorer fatal tire-related crashes in high-speed roadway rollovers compared to peer vehicles post-recall?



Defect Crises and NHTSA: Toyota UA Case Study

- A decade post-Firestone/Ford, the lack of a regulatory framework laid the foundation for a similar defect crisis.
- Complaints of unintended acceleration dogged Toyota for six years, but NHTSA's defect investigators could find nothing wrong except for floor mat interference in a small population of vehicles with a specific all-weather mat design.
- Toyota vehicles meet the federal accelerator controls standard, FMVSS 124 – which was promulgated in 1972 when throttles still had cables.



Defect Crises and NHTSA: Toyota UA Case Study

- Toyota vehicles meet the federal accelerator controls standard, FMVSS 124 – which was promulgated in 1972 when throttles still had cables.
- NHTSA attempted to upgrade the standard, but again, industry fought off any changes.
- In closing down an attempt to upgrade the rulemaking, NHTSA summarized manufacturers arguments:
 - “In general, the comments of vehicle and engine manufacturers did not address the specific questions in the notice. *Instead, they voiced a preference for rescinding the standard altogether, suggesting that market forces and litigation pressure are sufficient to assure fail-safe performance without a Federal motor vehicle safety standard.*” (Docket 2002-12845-001; 67 FR 48117; July 23, 2002)



Defect Crises and NHTSA: Toyota UA Case Study

- On August 28, 2009, A high-profile crash kills California Highway Patrolman and his family.
- The media questions the safety of Toyota's electronics in some of the most popular vehicles produced by the number-one automaker in the world.
- NHTSA investigates and finds causes no more complicated than errant floor mats, sticky pedals and driver error.



Defect Crises and NHTSA: Toyota UA Case Study

- Many complaints involve vehicles outside of any remedy.
- More than 300 consumer complaints to NHTSA claim UA after post-recall fix.
 - November 2010 fatal crash in Utah. Two surviving witnesses in the vehicle report that the driver attempted to repeatedly to disengage the cruise control and apply the brakes as he exited a highway off ramp. There was no floor mat interference.



Defect Crises and NHTSA

- The lack of safety requirements set the stage for both the Ford/Firestone and Toyota UA crises.
- Rulemaking is the process by which NHTSA develops institutional understanding of vehicle technology and functional outcomes.
 - Without that critical step, automakers are left to self-regulate;
 - NHTSA is left behind the technological curve.
 - When bad designs and manufacturing processes kill and injure, NHTSA is called upon to ferret out a defect, it may be ill-prepared to do so.
 - The more widespread the defect and more expensive the remedy, the more likely it is that the agency will settle for a fix it thinks it can get – whether it solves the full problem or not.



Firestone/Ford & Toyota Defect Crises

- Both crises involved popular, high-volume models made by companies who actively opposed the regulatory structure that could have prevented the damage to their reputations and bottom lines and to their customers.
- In both cases, solutions are complex and expensive.
 - How do you prevent or minimize the loss of control crashes that follow tread separations on an Explorer?
 - How do you prevent unwanted events that may find their way through an electronic architecture lacking robust failsafe design?
- Both may be economically prohibitive in a post-market environment.
- What is more tenable for a manufacturer?
 - Put the money into fighting a small defects office in a government agency ill-equipped to independently understand the issues and build a campaign around fighting the litigation, smearing critics, and recasting the problem as media-driven hype and consumer hysteria.



Firestone/Ford & Toyota Defect Crises

- High-drama defects siphon NHTSA's resources from planned injury reduction priorities.
- Absent regulation and investigators with *detailed and independent* understanding of current technology, the crises will continue to occur.



Automotive: Electronics

- Interesting electronic defect recalls:
 - Ford Thick Film Ignition (TFI): The first large case study in modern automotive electronic defect issues.
 - TNIs leading to TFI included electrical and thermo-mechanical failures – no single failure mode.
 - Outcome: **First judicially mandated recall.** Found Ford intentionally concealed information from NHTSA and the public.

(See: D.A. Thomas, et al., *The “trouble not identified” phenomenon in automotive electronics, 2002*)



Automotive: Electronics

- Recent Interesting Electronic Defect Recalls:
 - **2010 Ford Fusion / Mercury Milan Hybrid:** Brake software update. (see <http://news.consumerreports.org/cars/2010/02/ford-issues-prompt-fix-for-fusion-hybrid-brakes.html>)
 - **Toyota Prius / Lexus Hybrids:** Brake software update.
 - **2005 – 2010 selected Toyotas:** Brake Override software addition.
 - **2005 – 2008 Toyota Corolla:** ECM may have been improperly manufactured. Cracks develop at certain solder points or on varistors on the PCB causing the engine to shut off. (10V384)



Automotive: Electronics

- Recent Interesting Electronic Defect Recalls:
 - **2005 – 2006 Corvette:** Intermittent or open condition in a connector in the Steering Wheel Position Sensor (SWPS) causes a short-duration brake apply to one wheel. (10V172)
 - **2006 - 2008 Buick, Cadillac, Hummer, Chevy, GMC:** Heated wiper washer fluid system short circuit on the PCB can overheat causing a fire.



Automotive: Electronics

- Recent Interesting Electronic Defect Recalls:
 - **2007 Suzuki GSXR-1000:** ECM position for the Idle Speed Control (ISC) can keep the valve open causing a 5000 RPM idle speed. Replace the ISC and ECM. (07V362)
 - **2008 Volvo XC90:** Climate control module (CCM) may get a shut down signal from the ECM preventing the climate control functions – including defrost. ECM software will be upgraded. (07V563)



Automotive: Electronics

- Recent Interesting Electronic Defect Recalls:
 - **2004-2006 Nissan Armada, Titan, frontier, Pathfinder, Xterra; Infiniti QX56:** Intelligent Power Distribution Module (IPDM) assembly contains an ECM relay that has a diode for electrical noise reduction. The ECM may allow silicon vapor to form and over time evaporate from the diode molding causing silicon oxide to develop on the ECM relay contact and arc causing engine stalling. Replace the ECM relay inside the IPDM assembly.



Recall & Investigative Trends

- The role of “hype” in NHTSA investigations
 - Under hype hypothesis complaints after media exposure are not “real”
 - The result of mistaken description – what the consumer alleges isn’t really a match to the suspected defect or...
 - Extra reports obscure the true incidence of the problem in the field.



The Hype Hypothesis

- Examples
 - GM X-car rear brake lock-up
 - Toyota Tacoma SUA
 - Toyota SUA investigation with NASA
 - Jeep fuel spit back

(See “The Hype Hypotheses,” *Safety Record News*, Vol. 8 Issue 1, March 2011)



Recall & Investigative Trends

- The veil of science
 - NASA
- Repudiation of Consumer Complaints based on Secret Warranty data
 - Anti-scientific because the analysis can't be independently replicated.
 - Relies on “standards” set by recalled vehicle systems.
 - “With increased use of electronic components for driveability systems, a reliance on mere warranty data did not provide sufficient information for identifying driveability problems” (D.A. Thomas, et al)
- Transparency
 - Promises of transparency versus secrecy in actual practice.

NAS: Electronic Vehicle Controls and UA



Moving Forward

- **Pre-Failure:** Component level and component interaction testing, certification and ratings.
- **Failure:** Ensuring minimum levels of failsafe for safety critical electronic designs.
- **Post-Failure:** EDR, surveillance of safety data. Examination past investigations to avoid repeating mistakes and improving outcomes of countermeasures.
 - (i.e., inconsistent operation of critical safety systems should not be “driver mitigation” issues motorists have to accept, just as hundreds of fatal rollovers due to tire failures should not be the accepted norm.)



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