



Unintended Acceleration in Passenger Vehicles

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Summary

Congress is considering legislation to strengthen federal regulation of auto safety, in response to hundreds of reported accidents, and more than 50 fatalities, that may be linked to sudden acceleration in certain makes of Toyota and Lexus vehicles. Toyota, under pressure from the National Highway Traffic Safety Administration (NHTSA), has recalled more than 6 million autos in the United States, and for a time stopped production of certain new-model vehicles in an effort to address the problems—one of the largest such efforts in recent history. But lawmakers and consumer advocates say federal oversight has been inadequate, given that NHTSA began investigating reports of sudden acceleration in certain Toyotas in 2002. Internal corporate documents indicate that Toyota was slow to address other vehicle quality concerns. NHTSA in April 2010 fined Toyota \$16.375 million, the maximum allowed by law, for failing to quickly notify the U.S. Department of Transportation (DOT) of an accelerator pedal defect in some cars.

Adding to the complexity of the situation is continuing uncertainty about the cause of the Toyota incidents. Despite the recalls, a series of NHTSA investigations, and internal tests by Toyota engineers since 2002, there is not a consensus as to whether reported incidents of sudden acceleration have been caused by sticking accelerator pedals, poorly designed floor mats, driver error, glitches in the electronic throttle systems, or some combination of factors. DOT officials have expanded their investigation into Toyota operations, are taking a broad look at the increasingly complex electronics in all U.S. automobiles, and may recommend tougher standards for vehicles with electronic accelerators. At the same time, Toyota has announced its own stepped-up safety initiatives, including installing brake-override software (a system that gives priority to braking when the brake and accelerator are depressed at the same time) in some recalled and new-model cars, setting up an outside investigative panel headed by former Transportation Secretary Rodney Slater, and changing its corporate structure.

Lawmakers are considering a variety of issues as they craft a possible legislative response to the problems. Some Members of Congress are concerned that NHTSA did not conduct timely, thorough investigations of consumer complaints about Toyota vehicles and are examining whether the agency has sufficient staff and expertise, particularly in electrical and software engineering, to keep pace with the increasing complexity of autos. NHTSA has two electrical engineers on staff. Secretary of Transportation Ray LaHood has enlisted NASA engineers to assist NHTSA with its review.

Another issue is whether the 2000 TREAD Act, enacted in response to deaths and accidents linked to Firestone tires, has been effective. The act was designed to spur early warning of safety concerns, compel auto manufacturers to expeditiously address problems, and improve consumer information. The number of automotive recalls has increased since the TREAD Act was passed, but most of the recalls are voluntary, in part due to the lengthy legal process required in mandating a recall. Further, the DOT's \$16.375 million fine against Toyota is based on the DOT's determination that the company did not comply with the TREAD Act requirements to quickly report defects. Congress is also examining whether Toyota problems are signs of broader issues in the automobile industry. Electronics and software in automobiles account for as much as 40% of the cost of producing a car, and the systems are advancing to the point that they are used to control more essential safety features. U.S. and foreign automakers carry out extensive testing of software and electronics based on industry guidelines and their own, internal standards. The quality control system is less rigorous than for other areas of the transportation sector, however, such as aviation.

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Introduction

In August 2009, a California Highway Patrol officer was driving family members in a 2009 Lexus ES350 rental car when it accelerated to a high speed. The driver was not able to slow the car; it clipped another vehicle and careened off the road into a ravine, killing all four occupants. A passenger called 9-1-1 prior to the crash; the resulting recording captured the harrowing final seconds of the incident. The combination of the 9-1-1 audio and the driver's presumed driving expertise focused a great deal of attention on the accident and the broader issue of sudden unintended acceleration in Toyota vehicles.

The National Highway Traffic Safety Administration (NHTSA), an operating agency within the Department of Transportation (DOT) with chief responsibility for ensuring automobile safety, has received hundreds of consumer complaints about unintended acceleration in Toyotas going back at least to 2000. These complaints are not all the same; included within the general characterization of "sudden unintended acceleration" are instances where (1) a vehicle suddenly accelerates without any initiative by the driver, (2) a vehicle maintains its speed or continues to accelerate after a driver has released the accelerator pedal, and (3) a vehicle accelerates and the driver is unable to stop the vehicle by braking.

NHTSA has conducted eight examinations, including three investigations, of unexpected acceleration in Toyotas¹ during the past eight years. Toyota also has carried out its own internal studies. It was not until recently, however, that the NHTSA and Toyota investigations spurred major action. Toyota in 2007 issued a recall to address a body trim issue in Toyota Siennas that could interfere with the accelerator pedal. Since October 2009, Toyota has recalled more than 6 million Corolla, Camry, and Lexus ES model vehicles in the United States in an effort to remedy two defects identified as causing acceleration incidents: entrapment of the accelerator pedal by floor mats, and "sticking" accelerator pedals (i.e., a tendency for some accelerator pedals to return slowly after being released).² Toyota also temporarily stopped production of eight types of vehicles.³ Still, the recalls have not resolved all the reported cases of unexpected acceleration. Further, some vehicle owners have complained of problems even after Toyota has reworked their accelerators as part of its recalls. Starting in February 2010, Congress began a series of hearings to look into the issue, Toyota's actions, and NHTSA's authority, resources, and response to this issue.

The probe has expanded beyond potential problems in Toyota vehicles. Secretary of Transportation Ray LaHood announced on March 30, 2010, that the DOT had asked the National Academy of Sciences (NAS) to investigate unintended acceleration and electronic vehicle

¹ Ray LaHood, Secretary of Transportation, Testimony to the Senate Committee on Commerce, Science and Transportation, March 2, 2010, http://commerce.senate.gov/public/?a=Files.Serve&File_id=4dc57b2f-bd10-475d-84d7-d7f3759f1978.

² Toyota Motor Sales, "Customer FAQs Regarding the Sticking Accelerator Pedal and Floor Mat Pedal Entrapment Recalls," Press Release, February 3, 2010, <http://pressroom.toyota.com/pr/tms/customer-faqs-regarding-the-sticking-153495.aspx>. Toyota initially recalled 3.8 million vehicles in October, 2009 for issues relating to brake pedal entrapment, but expanded the recall to another 1.1 million vehicles in January 2010. Toyota on January 21 recalled 2.3 million vehicles to repair potentially sticky accelerator pedals. A number of cars were recalled for both pedal entrapment and sticky pedal issues.

³ Toyota Motor Sales, "Toyota Temporarily Suspends Sales of Selected Vehicles," Press Release, January 26, 2010, <http://pressroom.toyota.com/pr/tms/toyota/toyota-temporarily-suspends-sales-153126.aspx>.

controls “across the entire automotive industry.” In addition, NHTSA has enlisted National Aeronautics and Space Administration (NASA) engineers who are experts in software and electronics to examine the potential for problems with computer hardware or software or electronic systems in increasingly complex automobiles.⁴

NHTSA

To ensure that federal regulators receive early notification of potentially dangerous flaws in motor vehicles, and that auto manufacturers quickly take corrective action, Congress in 2000 passed the Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act (P.L. 106-414).⁵ The TREAD Act, developed in response to deaths stemming from flawed Firestone tires, created an “Early Warning” system requiring automobile vehicle and equipment manufacturers to promptly report data to NHTSA regarding defects, injuries, or deaths from auto vehicles or equipment. The law also required companies to report to NHTSA any recalls of its products in other countries within five days and imposed tougher penalties for manufacturers that did not comply with the act. The TREAD law was also designed to give consumers more timely and complete information about possible automotive safety issues.⁶

One of Congress’s intentions in passing the TREAD Act was to provide NHTSA with tools to identify potential defects more quickly. Some consumer groups and industry experts say NHTSA is still underfunded and does not have enough power to quickly force recalls, forcing it to instead negotiate with auto companies on less-sweeping sanctions. Critics, such as former NHTSA Administrator Joan Claybrook, also say that Toyota and NHTSA have not responded aggressively to reports of sudden acceleration. NHTSA officials reply that they acted promptly and repeatedly in response to information at hand. But, nonetheless, NHTSA in April 2010 levied a \$16.375 million fine against Toyota—the largest allowed under law—charging that the company did not comply with the TREAD Act requirement to promptly report safety problems to the agency.⁷

The most pressing issue, however, is that NHTSA⁸ inspectors have been unable to identify a cause or causes that would explain all the incidents of sudden or unintended acceleration. Toyota officials also say they have not found a mechanical or electrical problem that would account for complaints that do not seem to arise from defective floor mats or sticky accelerator pedals, which have been the subject of recalls. The net result is that there is currently no solution, or even explanation, for many of the reported incidents.

The DOT and Toyota officials are working to address the sudden acceleration complaints. Toyota has announced the creation of a special panel, headed by former Secretary of Transportation Rodney Slater, to examine quality and safety issues. Toyota will appoint, as part of this response, a safety officer in every country in which it has operations, and will open technical offices in some U.S. cities. The company has also said it will make brake override systems (software that

⁴ U.S. Department of Transportation, “U.S. Transportation Secretary Ray LaHood Announces Major Investigations to Resolve Issue of Sudden Acceleration,” Press Release, March 30, 2010.

⁵ P.L. 106-414; H.Rept. 106-954, p. 7.

⁶ *Ibid.*

⁷ Department of Transportation, “Secretary LaHood Announces DOT is Seeking Maximum Civil Penalty from Toyota,” Press Release, April 5, 2010, <http://www.nhtsa.gov/>.

⁸ Although there has been some criticism of NHTSA for not responding sooner, NHTSA initiated eight examinations, including three formal investigations, of sudden unintended acceleration in Toyotas between 2003 and 2009.

gives priority to braking when the brake and accelerator are depressed at the same time) standard on new model cars.⁹ The company is installing brake override systems in recalled models, when possible.

Consumer groups are pressing Toyota and NHTSA to look more closely at the possibility that the incidents may have been caused by defects in the vehicles' electronic systems.¹⁰ Both NHTSA and Toyota officials say their research has, so far, not detected software or electronic issues, particularly with electronic throttle controls. In addition to LaHood's announcement that the DOT has asked for studies from the NAS and help from NASA engineers, the Transportation Secretary has asked the DOT Inspector General (DOTIG) to determine whether NHTSA conducted an adequate review of alleged unintended acceleration and has the necessary staff. He has also indicated that the Obama Administration is considering requiring all auto manufacturers that produce cars with electronic throttle controls to install an emergency brake override on their vehicles. Such systems are already standard on certain makes of automobiles.

Congress is now considering amending the TREAD Act or taking other steps to enhance NHTSA's power and, as a result, public safety. Senate Committee on Commerce, Science, and Transportation Chairman Jay Rockefeller of West Virginia said during a March 2, 2010, hearing that he wants to proceed expeditiously with legislation. In the House, the Committee on Energy and Commerce and the Committee on Oversight and Government Reform have launched their own investigations into the sudden acceleration cases, and the response of Toyota and NHTSA. Lawmakers are also considering the FY2011 budget for DOT, including NHTSA. Secretary of Transportation Ray LaHood told Congress that President Obama's FY2011 budget includes authority for an additional 66 full-time equivalent positions at NHTSA.¹¹ There are currently 57 full-time NHTSA employees devoted to safety investigations. DOT officials have said they will determine how many of the new positions will be used for safety investigations.

Federal Oversight of Auto Safety

NHTSA is the federal agency with primary responsibility for regulating motor vehicle safety, including setting motor vehicle safety standards. It is also the main agency charged with identifying motor vehicle safety defects through its Office of Defects Investigation (ODI). The ODI receives complaints from consumers and certain information from manufacturers, assesses the information to determine whether there appear to be trends indicating potential safety defects, and conducts investigations to determine whether the evidence indicates the presence of problems. When a safety defect is identified, manufacturers are required to provide owners of the affected vehicles with a remedy at no cost to the owners.

⁹ Yoshimi Inaba, President and COO Toyota North America and Chairman and CEO of Toyota Motor Sales, testimony to the Senate Committee on Commerce, Science and Transportation, March 2, 2010, http://commerce.senate.gov/public/?a=Files.Serve&File_id=551444b7-8cd8-4999-8735-ec29431aa3fe.

¹⁰ Joan Claybrook, President Emeritus, Public Citizen, testimony before the U.S. Congress, House Committee on Oversight and Government Reform, *Hearing on Toyota Gas Pedals: Is the Public at Risk?*, February 24, 2010.

¹¹ Ray LaHood, Secretary of Transportation, Testimony to the House Committee on Oversight and Government Reform, February 24, 2010, http://oversight.house.gov/images/stories/Hearings/Committee_on_Oversight/2010/022410_Toyota/TESTIMONY-LaHood.pdf.

Congress, over the years, has attempted to strengthen NHTSA's authority, most recently with the October 2000 passage of the TREAD Act. The measure was drafted out of concern that NHTSA did not respond quickly enough to a number of crashes and deaths that ultimately led to the recall of millions of Firestone tires.¹² The TREAD Act included provisions to increase the amount of data available to NHTSA regarding potential safety defects, and authorized more funding to improve NHTSA's capacity to more quickly analyze data. (See **Appendix A** for additional context and more details.)

The TREAD Act obligates manufacturers to notify NHTSA within five days of determining that a safety defect exists. A key provision is an Early Warning Reporting (EWR) requirement (section 3(b)). The EWR requires manufacturers to regularly share with NHTSA certain information they receive about their vehicles or equipment. Specifically, manufacturers are required to report on a quarterly basis:

1. The number of vehicles, tires, and child restraint systems, by make, model, and model (production) year, that were produced;
2. The number of claims and notices involving death (including those in foreign countries), personal injury, and property damage by make, model, model year, and vehicle identification number;
3. The number of paid warranty claims in the United States that involve specified components and systems;
4. The number of field reports received from the manufacturer's employees, representatives, dealers, and fleets, related to problems with specified components and systems, and copies of all field reports (except those from dealers); and
5. All consumer complaints received regarding a product.

Other provisions require manufacturers to inform NHTSA of safety recalls or other safety campaigns conducted in foreign countries on motor vehicles or equipment similar to those sold in the United States.

The average number of annual automotive defect recalls in the United States has increased from 486 during 2000-2004 to 524 during 2005-2009. (See **Table 3**.) About 22% of all recalls from 2005-2009 were ordered by NHTSA; the rest were voluntary actions announced by auto companies—including the most recent Toyota recalls.¹³ Consumer groups say the percentage of government-ordered recalls is small, indicating that NHTSA is not tough enough, and that auto companies can negotiate less onerous penalties. NHTSA Administrator David Strickland told Congress in March 2010 that voluntary recalls are often preferable, since NHTSA-ordered actions can be subject to lengthy delays. For example, if a manufacturer resists a NHTSA recall order, the agency must go to court to prove that a defect exists that creates an “unreasonable safety risk.”¹⁴

¹² United States Department of Transportation, Office of Inspector General, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, p. 1, <http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2002071.pdf>.

¹³ Greiling Keane, Angela and Jeff Plungis, “Toyota Acceleration Tied to 43 Fatal Crashes,” *Bloomberg*, March 2, 2010.

¹⁴ David Strickland, NHTSA Administrator, Testimony to the House Energy and Commerce Subcommittee on Commerce, Trade and Consumer Protection, March 11, 2010, http://energycommerce.house.gov/Press_111/20100311/Strickland.Testimony.pdf.

NHTSA estimates that about half the investigations it opens result in a safety recall or other manufacturer action.¹⁵ (For further information on NHTSA's Defects Investigation Process, see **Appendix B.**)

Sudden Acceleration Complaints

Since 2000, NHTSA has received about 30,000 to 50,000 complaints annually about a wide array of potential problems and defects in automobiles. About 2% to 5% of the overall complaints each year have involved reports of possible unintended acceleration.¹⁶ Since 1980, NHTSA has carried out 141 investigations into consumer throttle-control complaints in a variety of automobiles, involving both electronic and mechanical throttles.¹⁷

Determining the cause of sudden acceleration is often difficult. A problem may occur rarely, for example, or NHTSA may not be able to reproduce a specific incident reported by a consumer. Further, there are several potential causes for sudden acceleration: driver error; design defects that may induce driver error (such as poor pedal placement); the absence of a shift interlock (a shift system designed to make it more difficult for a person to accidentally shift a car into drive); interference from floor mats; mechanical or electromechanical defects; and electronic defects.¹⁸

Several studies conducted by NHTSA and vehicle safety agencies in other countries have concluded that driver error—inadvertently pressing the accelerator when intending to press the brake—is generally the cause of unintended acceleration.¹⁹ Critics of this explanation in the Toyota case observe that these studies were done on 1980s-era vehicles, and thus are of uncertain value in examining contemporary vehicles that use new technologies.²⁰

Audi Historical Precedents

One of the most prominent studies linking driver error to unintended acceleration arose from a 1980s federal investigation into reported problems in Audi automobiles. In the mid-1980s, NHTSA received a number of complaints from vehicle owners who alleged that their Audi 5000 automobiles had suddenly accelerated as they shifted their automatic transmission from park to drive or reverse. The New York Attorney General and consumer groups requested an investigation.²¹ The television program *60 Minutes* aired a segment that purported to show an out-

¹⁵ United States Department of Transportation, National Highway Traffic Safety Administration, *FY 2011 Congressional Budget Justification*, p. 55, <http://www.dot.gov/budget/2011/budgetestimates/nhtsa.pdf>.

¹⁶ NHTSA, "Toyota Sudden Acceleration, Background & Timeline of NHTSA Actions," Fact Sheet.

¹⁷ Ray LaHood, Secretary of Transportation, Testimony to the Senate Committee on Commerce, Science and Transportation, March 2, 2010, p. 7.

¹⁸ Safety Research and Strategies, Inc., "Sudden Unintended Acceleration Redux: The Unresolved Issue," *The Safety Record*, v. 6, 13, June-July 2009, <http://www.safetyresearch.net/2009/07/20/sudden-acceleration/>.

¹⁹ These studies include John Pollard and E. Donald Sussman, *An Examination of Sudden Acceleration*, NHTSA, 1989, DOT-HS-8007-367; Transport Canada, *Investigation of Sudden Acceleration Incidents*, December 1988; Japanese Ministry of Transport, *An Investigation on Sudden Starting and/or Acceleration of Vehicles with Automatic Transmission*, April 1989.

²⁰ Clarence Ditlow, Executive Director, Center for Auto Safety, testimony to the Senate Commerce, Science and Transportation Committee, March 2, 2010, http://commerce.senate.gov/public/?a=Files.Serve&File_id=1c6bb866-8a96-4f79-b6ac-84a6a0e805f5.

²¹ Hearit, Keith Michael, and Jeffrey L. Courtright, "A Social Constructionist Approach to Crisis Management: (continued...)"

of-control Audi.²² Audi in 1986 announced a recall and installed a gear shift lock that required consumers to depress the brake pedal in order to shift into gear. Still, U.S. Audi sales plummeted from 74,000 vehicles in 1985 to a low of 12,000 in 1991, before beginning a slow rebound.²³ The resale value of Audi makes, including those not involved in the recall, declined substantially.²⁴ In 1989, NHTSA released a comprehensive study it had commissioned from an outside research group that examined the Audi incidents, as well as other makes of automobiles, to look for a potential cause of the sudden acceleration. The study concluded that the reported sudden acceleration was caused by driver error.²⁵

NHTSA officials have referred to the Audi case as they have looked into recent reports of sudden acceleration in Toyotas and other vehicles. For example, NHTSA in 2003 denied a petition for an investigation into reports that Toyota's Lexus 300 and 400 model autos were prone to unexpected acceleration. In announcing its decision, NHTSA said the data did not provide a "reasonable possibility" that an investigation would result in an order of a safety-related defect and remedy.²⁶ To reach that conclusion, NHTSA officials examined 182 consumer complaints for three models of vehicles in five NHTSA categories related to issues of speed control including throttle linkages and cruise control systems. The review covered the period from 1997 to 2000. Based on the data, NHTSA officials determined that Lincoln-make automobiles had a higher complaint rate, 10.6 per 100,000, than the Lexus, 10.0 per 100,000. Cadillac had 8.7 complaints per 100,000 vehicles.²⁷ NHTSA did a second review limited to just one speed control category. That turned up similar results with 1.2 complaints per 100,000 for Lexus, 1.8 for Lincoln and .76 for Cadillac. In deciding not to proceed with an investigation, NHTSA also referred extensively to the 1989 Audi study linking unintended acceleration to human error.

(...continued)

Allegations of Sudden Acceleration in the Audi 5000," *Communications Studies*, vol. 54, Issue 1, Spring 2003.

²² Huber, Peter, *Galileo's Revenge: Junk Science in the Courtroom*, Perseus Book Group, 1991, p. 57.

²³ White, Joseph B. and Dionne Searcey, "Audi Case Set Template for Toyota's Troubles," *Wall Street Journal*, March 12, 2010, <http://online.wsj.com/article/SB10001424052748704349304575115952186305536.html>.

²⁴ Hearit, Keith Michael and Jeffrey L. Courtright, "A Social Constructionist Approach to Crisis Management: Allegations of Sudden Acceleration in the Audi 5000," *Communications Studies*, vol. 54, Issue 1, Spring 2003.

²⁵ Pollard, John and E. Donald Sussman, *An Examination of Sudden Acceleration*, Transportation Systems Center, Cambridge, MA.: NHTSA, 1989, DOT-HS-807-367.

²⁶ U.S. Department of Transportation, National Highway Traffic Safety Administration, "Denial of Motor Defect Petition," DP03-003, Federal Register, vol. 68, No. 183, September 22, 2003, p. 55076.

²⁷ Ibid. According to NHTSA, there is no set benchmark figure of complaints per 100,000 that indicates problems with a vehicle. The rate of consumer complaints bears on both the question of whether there is a defect and whether the defect is related to motor vehicle safety. Under case law, in assessing whether there is a defect, relevant considerations include the failure rate of the components in question, failure rates of comparable components, and the importance of the component to the safe operation of a vehicle. NHTSA uses a risk analysis approach when examining consumer complaints, weighing for potential safety risks and frequency. In some cases it is sufficient to look at complaint rates, according to NHTSA. In other instances it is important to look at rates normalized by the number of vehicles or miles driven. In other instances, such as early in the life of a vehicle where the consequences of a problem could be deadly, but there may not be sufficient numbers of incidents to determine a rate, the issue could, nonetheless, merit opening an investigation. Further, a defect that results in a loss of vehicle control presumptively presents an unreasonable risk of a crash. But to complete a recall, NHTSA would have to prove that the loss of control was related to a defect, and could not simply rely on complaints alleging a loss of control.

Toyota-Related Complaints Since 2000

NHTSA data indicate that the agency has received a range of 1,200 to 2,000 complaints annually since 2000 specifically regarding sudden or unintended acceleration in a range of vehicles. Toyota vehicles accounted for about 4% of all such reports in 2000, a share that rose to 17% in 2008 and 33% in 2009. The increased incidence of complaints occurred as domestic sales of Toyota vehicles climbed substantially, meaning Toyota cars made up a larger proportion of all U.S. autos.²⁸ Of the Toyota complaints involving sudden unintended acceleration during the period 2000 to 2010, 43 involved fatal crashes; these 43 crashes resulted in 52 deaths. Thirty-three of the 43 crashes involved vehicles equipped with electronic throttle controls; fully three-quarters of the reports were received since November 2009, following increased media attention to the sudden acceleration issue (some of the reports apparently referred to crashes that occurred months or years before).²⁹

Another way to break down the data is to look at the number of complaints per 100,000 automobiles. According to an analysis by auto industry publisher Edmunds.com, based on 2005-2009 data, Toyota had 4.81 complaints per 100,000 vehicles sold, compared to Ford with 3.12 complaints. (See **Table 1**.) Toyota has had more complaints of unintended acceleration on its newer-model vehicles—autos sold from marketing year 2005 through September 30, 2009—than any of the other so-called Big 6 auto manufacturers, according to Edmunds.com.³⁰

Table 1. Complaints of Unintended Acceleration in Selected Brands

Data for cars sold in United States from 2005 through September 2009

Manufacturer	Complaints	Sales	Complaints Per 100,000 Vehicles Sold
Chrysler	156	9,082,757	1.72
Ford	339	10,864,479	3.12
GM	134	16,542,608	0.81
Honda	89	7,059,784	1.26
Nissan	50	4,657,974	1.07
Toyota	532	11,049,513	4.81

Source: Edmunds.com (<http://www.edmunds.com/>).

Notes: Data is for sales of vehicles MY2005 and Newer. Complaints are for MY2005 and newer received by NHTSA through September 30, 2009.

State Farm Insurance Co. reported to NHTSA in 2004 that it had seen an increase in insurance claims related to unintended acceleration in Camry and Corolla vehicles. State Farm noted that the claims surged beginning with the model year 2002 Camrys, in which Toyota had introduced an electronic throttle. State Farm claims relating to Toyota Corollas also increased after the

²⁸ NHTSA, “Toyota Sudden Acceleration Timeline.”

²⁹ Keane, Angela Greiling and Jeff Plungis, “Toyota Sudden Acceleration Tied to 43 Fatal Crashes,” *Bloomberg.com*, March 2, 2010.

³⁰ *Edmunds AutoObserver*, “Question Congress’ Hearings Won’t Answer: Are Cars Safe?” February 25, 2010, <http://www.autoobserver.com/2010/02/question-congress-hearings-wont-answer-are-cars-safe.html>. The Big 6 manufacturers are Chrysler, Ford, GM, Honda, Nissan, and Toyota.

introduction of the electronic throttle in those vehicles in model year 2005. After an initial spike, claims decreased, though Corolla complaints in 2009 were still generally higher than in the years preceding the change.³¹

Consumer Reports in 2009 performed its own breakdown of NHTSA data, finding that more than 40% of sudden acceleration complaints filed with the federal agency on model year 2008 vehicles involved Toyota or Lexus vehicles. The magazine said that Ford Motor Co. also had a significant number of complaints relating to acceleration issues. *Consumer Reports'* Auto Test Center and Statistics Department examined 5,916 reports dealing with 2008 models and found 166 cases of unintended acceleration. The complaints ranged across 22 brands, however, including 47 complaints about Toyota and five about Lexus vehicles, and 36 complaints about the Ford F-150 pickup.³²

NHTSA Response to Toyota Complaints

Since 2002, NHTSA has conducted eight examinations, including three investigations, into complaints of unintended acceleration in Toyotas. It closed most of these examinations after it was not able to identify a safety defect that could have caused the complaint. (See Toyota recall timeline, **Appendix C**.) An investigation led to a Toyota recall in 2007 to address a body trim issue in Toyota Siennas that could interfere with the accelerator pedal. More recently, two NHTSA examinations led to Toyota recalls in 2009 and 2010 covering floor mats and potentially sticky accelerator pedals. NHTSA's acting administrator traveled to Japan in December 2009 to meet with Toyota officials and impress on them the need to quickly address reported problems. According to press reports, some owners of Toyota vehicles have complained that their vehicles exhibited sudden unintended acceleration after being recalled and repaired.³³

The DOTIG is also conducting an audit of NHTSA's Office of Defects Investigation. The audit will examine both ODI's process for identifying and investigating potential defects, as well as the office's actions in regard to the Toyota recalls.³⁴ The last audit of the ODI was published in 2004, examining NHTSA's implementation of the TREAD Act.

The DOT on April 5, 2010, announced that it had determined that Toyota did not comply with legal requirements to notify NHTSA within five days of discovering a safety flaw in its products. Transportation Secretary LaHood announced that officials would seek a \$16.375 million penalty against Toyota, the maximum possible, for what it said was a failure to notify NHTSA, for at least four months, of sticky accelerator pedals in some Toyota models.³⁵ NHTSA said internal Toyota

³¹ "State Farm UIA Claims (Pre-ETC v. Post ETC), NHTSA Document Produced to [House Energy and Commerce] Committee on February 19, 2010," http://commerce.senate.gov/public/?a=Files.Serve&File_id=ddacce41-aed1-4e47-8c5c-4384bd7522ac.

³² Limbach, James, "Toyota, Lexus Lead the Pack for Sudden Acceleration Problems," *ConsumerAffairs.com*, December 9, 2009, http://www.consumeraffairs.com/news04/2009/12/cr_sudden_acceleration.html.

³³ Associated Press, "Toyota Will Replace Pedals, If Asked," *Boston Globe*, March 24, 2010, http://www.boston.com/business/articles/2010/03/24/toyota_will_replace_pedals_if_asked/.

³⁴ Office of the Inspector General, United States Department of Transportation, "Audit Initiated of NHTSA's Office of Defects Investigation," February 19, 2010, <http://www.oig.dot.gov/library-item/5271>.

³⁵ Ray LaHood, Secretary of Transportation, Testimony to the House Committee on Oversight and Government Reform, February 24, 2010. Department of Transportation, "Secretary LaHood Announces DOT is Seeking Maximum Civil Penalty from Toyota," Press Release, April 5, 2010, <http://www.nhtsa.gov/>.

documents showed that the company knew of the problems with the pedals since at least September 29, 2009, when it issued repair procedures to distributors in 31 European countries and Canada. About 2.3 million Toyota vehicles were recalled in the United States in late February for sticky pedal issues. Toyota on April 19, 2010, agreed to pay the penalty. Toyota said in a statement that the company acted to avoid prolonged litigation and to move forward on quality improvements.³⁶ Toyota on April 19, 2010, also announced it would recall 2010 model Lexus GX 460 vehicles to update their Vehicle Stability Control system.

Toyota Overview

Japan-based Toyota Motor Co. has grown into an international powerhouse since its founding in 1937, and now manufactures cars and trucks, motors, air conditioning units, factory equipment, and other machinery.³⁷ Toyota has undergone a particularly rapid period of expansion during the past two decades. Toyota's share of the U.S. auto market nearly doubled between 1998 and 2009.³⁸ (See **Figure 1.**) In 2008, Toyota moved ahead of General Motors as the world's largest auto company, in terms of annual sales.³⁹ Toyota has long been known for its "lean" manufacturing process, and the company's ability to produce cars more efficiently than its competitors has given it a competitive edge. Toyota has managed to maintain its productivity during the past several decades even as automobiles have become more complex to design and produce, though the gap between Toyota and U.S. auto firms appears to have narrowed.⁴⁰

Toyota has a major U.S. presence, measured in both sales and production. Toyota began selling its vehicles in the United States in 1957, with the founding of Toyota Motor Sales.⁴¹ It also sells its Lexus brand. In 1984 the firm started domestic U.S. production as part of a joint venture with General Motors. Toyota now has 13 manufacturing locations in North America (including Mexico and Canada) that produce vehicles including the Sequoia, Tacoma, Venza, and Avalon.⁴² Toyota employs about 29,000 U.S. workers, and its direct U.S. investment has grown to more than \$18 billion. The firm spent more than \$22 billion on parts, materials, and components from U.S. suppliers in 2009. Toyota sold 1.77 million cars and light trucks in the United States in 2009. Of that total, about 1.1 million were made in this country and 663,844 were imported.⁴³

³⁶ Toyota Motor Corporation, "Toyota Motor Corporation Agrees to Settle NHTSA Civil Penalty," Press Release, April 19, 2010, <http://pressroom.toyota.com/pr/tms/toyota-motor-corporation-agrees-157093.aspx>.

³⁷ Toyota, *History of Toyota*, Timeline, <http://www2.toyota.co.jp/en/history/>.

³⁸ Wards Automotive Group, *U.S. Vehicle Sales Market Share by Company, 1961-2009*, <http://wardsauto.com/keydata/>.

³⁹ Bunkley, Nick, "Toyota Ahead of G.M. in 2008 Sales," *New York Times*, January 21, 2009, <http://www.nytimes.com/2009/01/22/business/22auto.html>.

⁴⁰ Oliver Wyman Harbour Report, "Lean Improvements, Worker Buyouts Bring Detroit Three Productivity Closer to Asian Rivals, Says Oliver Wyman's Harbour Report 2008," Press Release, June 5, 2009, http://www.oliverwyman.com/content_images/OW_EN_Automotive_Press_2008_HarbourReport08.pdf.

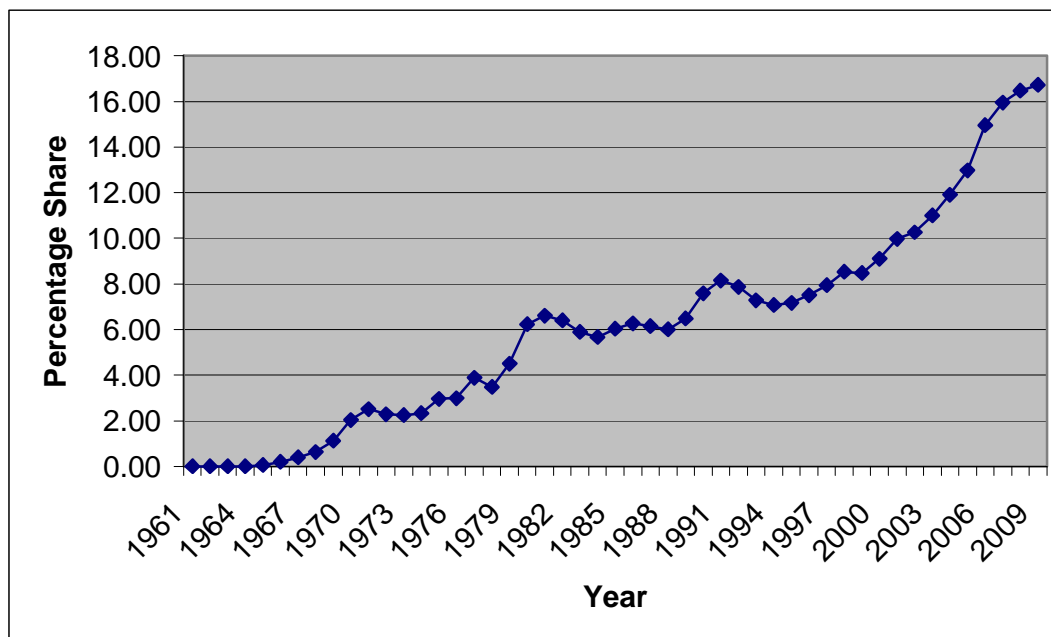
⁴¹ Center for Automotive Research, *Contribution of Toyota Motor North America to the Economies of Sixteen States and the United States in 2006*, October 2007, p. iii, http://www.cargroup.org/documents/Toyota_16_State_Final.pdf.

⁴² Toyota, *Toyota in the United States*, http://www.toyota.com/about/our_business/our_numbers/.

⁴³ *Automotive News Data Center*.

Figure I. Toyota U.S. Auto Market Growth

Percentage share of U.S. vehicle sales from 1961-2009



Source: Ward's Automotive Group, *U.S. Vehicle Sales Market Share by Company, 1961-2009*.

North America is the largest market for Toyota vehicles. In February 2010, Toyota forecast it would sell 2.05 million cars in North America during its 2010 fiscal year (April-March) out of total forecast global sales of 7.2 million.⁴⁴

Toyota Motor Engineering and Manufacturing, headquartered in Erlanger, KY, carries out design and development for U.S. manufacturing operations. Toyota Financial Services provides loans for car buyers, so-called floor-plan loans that provide dealers needed financing to stock inventory, and handles lease coverage and vehicle service/warranty agreements and other financial services for Toyota, Lexus, and Scion dealers, Toyota forklift and Hino dealers, and Toyota Material Handling dealers and affiliates. Toyota Financial Services employs 3,000 U.S. workers with managed assets in excess of \$65 billion.⁴⁵

Toyota Corporate Structure

As Toyota has expanded, the company has increased its range of products and built manufacturing plants in a number of countries, including the United States. There have been suggestions that Toyota put too much emphasis on expansion at the expense of quality. Further, there have been criticisms that management, which remained centralized in Japan, was slow to respond to problems in its U.S. operations. In a September 2006 internal Toyota presentation entitled "A New Era for Toyota and TMA in North America," then-Toyota Motors North America

⁴⁴ Toyota Motor Corporation, *FY 2010 Third Quarter Financial Results*, February 4, 2010, p. 20. http://www.toyota.co.jp/en/ir/financial_results/2010/q3/presentation.pdf.

⁴⁵ Toyota Financial Services, *Company Background*, http://www.toyotafinancial.com/consumer/tfs.portal?_nfpb=true&_pageLabel=pg_CompanyBackground.

President Jim Press noted increasing recall activity and federal investigations. Press said that quality problems affected customer loyalty and suggested that the company's credibility with NHTSA was slipping. Notes accompanying the slides in Press's Power Point presentation included this entreaty to corporate managers: "We ask TMC to trust our judgment when we need your urgent help in getting issues resolved. We need faster information flow, and more technical support when hot issues arise."⁴⁶

James Lentz, president and COO of Toyota Motor Sales, USA, in February 23, 2010, testimony before the House Energy and Commerce Committee said that Japanese officials had been making the key decisions on recalls, but said the process was changing.⁴⁷ Toyota CEO Akio Toyoda, a grandson of Toyota's founder who became CEO in 2009, has personally apologized to customers, saying the corporation may have grown too big, too fast and, in the process, lost its focus on quality and customer response. Toyoda has proposed changes in Toyota's corporate structure to ensure it responds more quickly and openly to safety and quality questions in the future.⁴⁸

Toyota officials have laid out a series of steps that they say should improve product quality and consumer satisfaction:

- Establish a Special Committee for Global Quality, to be led by the president of Toyota. The panel will review operations and suggest needed changes.
- Create an outside panel of industry experts to evaluate any new quality controls within Toyota. The panel will be headed by former U.S. Secretary of Transportation Rodney Slater.
- Create a global system to better share information within the company and with regulators, including NHTSA.
- Set up teams of technicians in select U.S. cities to quickly respond to reports of unintended acceleration in Toyota vehicles and make on-site inspections.
- Create a new U.S. position of regional product safety executive. Corporate officials have also said they will give North American Toyota managers more autonomy to make decisions about safety and defect issues.
- Establish an Automotive Center of Quality Excellence in the United States.⁴⁹

⁴⁶ Press, Jim, President of Toyota North America, *A New Era for Toyota and TMA in North America*, September 20, 2006, http://commerce.senate.gov/public/?a=Files.Serve&File_id=983799ea-1bdb-493c-8a47-a3401be4d3e3.

⁴⁷ James Lentz, President and Chief Operating Officer, Toyota Motor Sales USA, testimony to the House Committee on Energy and Commerce, February 23, 2010, http://energycommerce.house.gov/Press_111/20100223/Lentz.Testimony.pdf.

⁴⁸ Akio Toyoda, President, Toyota Motor Corporation, testimony to the House Committee on Oversight and Government Reform, February 24, 2010, http://oversight.house.gov/images/stories/Hearings/Committee_on_Oversight/2010/022410_Toyota/TESTIMONY-Toyoda.pdf.

⁴⁹ Yoshimi Inaba, President and COO Toyota North American and Chairman and CEO of Toyota Motor Sales, Testimony to the Senate Committee on Commerce, Science and Transportation, March 2, 2010, http://commerce.senate.gov/public/index.cfm?p=Hearings&ContentRecord_id=5a15bd95-d0c7-4171-9aee-cc8420e9265f&Statement_id=7628d978-89f5-420a-872a-bd21f22056c0&ContentType_id=14f995b9-dfa5-407a-9d35-56cc7152a7ed&Group_id=b06c39af-e033-4cba-9221-de668ca1978a&MonthDisplay=3&YearDisplay=2010.

Black Box Availability

Toyota is also pledging to become more open in another area. The company has been faulted for making it difficult for U.S. investigators and drivers to gain access to electronic “black box” data for its vehicles that might help to determine the causes of some of the incidents.

In many automobiles, an event data recorder (EDR), commonly referred to as a “black box,” records information related to a vehicle crash. An automobile “black box” is different from a commercial aircraft’s flight recorder (also popularly referred to as a “black box”), which records both equipment data and audio transmissions. An automobile “black box” continually records information from a vehicle’s brakes, seat belts, and air bags; the recording is of short duration, and the recorded information is continuously overwritten by new information, so that at any time there is usually only a few seconds of data recorded. The EDR will store information about the condition of the brakes, seat belts, and air bags for a few seconds before and during a crash. Some EDRs also record data such as engine throttle status and vehicle speed.⁵⁰ EDRs began to appear in cars as early as 1991; most cars now have an EDR. NHTSA has been collecting EDR data since 1991 because of its value in helping investigators reconstruct vehicle crashes. In 2006, NHTSA issued a regulation to standardize the data collected by EDRs. The regulation takes effect in 2012, affecting model year 2013 cars.⁵¹ While the rule will require that EDRs record 15 types of data, including throttle status and vehicle speed, it applies only to cars that have EDRs; the regulation does not require that cars be equipped with EDRs.

Toyota engineers describe their EDRs as essentially prototype parts that were designed as event recorders. “There have been times—there have been occurrences where we have been able to download some information regarding throttle angles, steering angle, brake application, et cetera, that does give us some information. But that’s very, very limited, and hasn’t really occurred that often,” John Hanson, national environmental safety and quality communications manager for Toyota said in a recent presentation.⁵²

Toyota until recently had just one device in the United States capable of reading its vehicles’ proprietary black box data. By contrast, other automobile companies make their black box data more accessible to consumers and investigators. In hearings before Congress, Toyota executives pledged that they would provide 100 such devices. Toyota is also stepping up efforts to improve black box technology on its upcoming models of automobiles.⁵³

Recall Impact on Toyota Sales

Even before the recent recalls Toyota, like other automobile companies, had been hurt by the economic downturn and credit crunch. Toyota officials reacted with aggressive marketing in the wake of the bad publicity surrounding the sudden acceleration incidents. On March 2, 2010,

⁵⁰ NHTSA and the Insurance Institute for Highway Safety, “Q&As: Event Data Recorders,” November 2009, <http://www.iihs.org/research/qanda/edr.html>.

⁵¹ National Highway Traffic Safety Administration, Department of Transportation, “Event Data Recorders; Final Rule,” 71 *Federal Register* 50998, August 28, 2006.

⁵² Toyota Motor Sales, 2010 Toyota Electronic Throttle Control Webinar, February 22, 2010, <http://pressroom.toyota.com/pr/tms/2010-toyota-electronic-throttle-154266.aspx>.

⁵³ Reuters, “Factbox—What has Toyota pledged to change?” February 23, 2010, <http://www.reuters.com/article/idUSN2312046420100224>.

Toyota announced a series of financial incentives through April 5, 2010, designed to lure buyers into its dealer showrooms. The company offered 0% financing or lower monthly lease rates on some popular models, as well as a complimentary two-year maintenance program for customers who buy or lease a new car and provide proof that they already own a Toyota make of vehicle.⁵⁴

Toyota Motor Sales, USA reported on April 1, 2010, that it sold 186,863 automobiles in March, a 35.3% increase compared to the same period in 2009.⁵⁵ For the first quarter of 2010, sales were up 8.7% from year-ago levels, measured in sales per day. Sales rose 7.2% on an unadjusted volume basis—the difference comes from the fact that there were 74 selling days in the first quarter of 2010 compared to 75 in the first quarter of 2009. Still, some analysts have estimated that Toyota could face billions of dollars in losses from the sudden acceleration cases.⁵⁶

Toyota Lobbying

In addition to technical issues, lawmakers have questioned whether Toyota lobbyists were able to persuade NHTSA officials not to order recalls in certain instances.

In 2009, Toyota had a larger lobbying force in Washington, DC, than any other foreign automobile company. According to the nonprofit Center for Responsive Politics, Toyota and its subsidiary organizations spent more than \$5 million and employed 31 lobbyists in 2009.⁵⁷ By comparison, Nissan Motors, another large foreign auto firm, spent \$3.67 million and employed 19 lobbyists, while Honda had nine lobbyists and spent \$2.56 million during the period.⁵⁸ Honda, for example, also has a major U.S. presence. The company opened its first U.S. plant in 1979 and now directly employs more than 25,000 Americans.⁵⁹

Lawmakers have focused on a July 6, 2009, document prepared by Toyota's Washington office for Toyota Motors COO Yoshi Inaba. In that document, the office claimed a number of "wins" including delaying final safety rules by NHTSA, and persuading NHTSA officials to impose lesser defect sanctions, including a negotiated equipment recall on Camrys that saved the company \$100 million. Inaba told lawmakers during congressional hearings that the document does not reflect official Toyota policy and that he does not know where the \$100 million figure came from.

A number of former DOT employees now work for Toyota and other auto companies.⁶⁰ Secretary of Transportation Ray LaHood told Congress that a review of internal records indicates that the

⁵⁴ Toyota Motor Sales, "Toyota Announces March Sales Event," Press Release, March 2, 2010, <http://pressroom.toyota.com/pr/tms/toyota-announces-march-sales-event-154598.aspx>.

⁵⁵ Toyota Motor Sales, "Toyota Announces March and First Quarter Sales," Press Release, April 1, 2010, <http://www.toyota.com/about/news/corporate/2010/04/01-1-sales.html>.

⁵⁶ Sanchanta, Mariko and Yoshio Takahashi, "Toyota Recall Losses Could Top \$5 Billion," *Wall Street Journal*, March 9, 2010, <http://online.wsj.com/article/SB10001424052748704145904575111341893725992.html?KEYWORDS=toyota>.

⁵⁷ Levinthal, Dave, "Toyota's Lobbying Power Primed for Test as Congressional Scrutiny Mounts," *OpenSecrets.org*, Center for Responsive Politics, February 8, 2010, <http://www.opensecrets.org/news/2010/02/toyotas-lobbying-power-primed.html>.

⁵⁸ *Ibid.*

⁵⁹ Honda, *Operations Overview*, <http://corporate.honda.com/america/overview.aspx>.

⁶⁰ *Bloomberg*, "Regulators Hired by Toyota Helped Halt Acceleration Probes," February 13, 2010, <http://www.bloomberg.com/apps/news?pid=20601087&sid=atXvi2msqPOM>.

former officials have complied with laws that limit their ability to lobby their former colleagues. The Transportation Secretary has suggested tightening the lobbying laws, however.

Policy Issues and the Congressional Response

The increase in consumer complaints regarding sudden acceleration in Toyota vehicles, and the government and industry response, has led some Members of Congress, and consumer and industry groups to examine a number of issues regarding the specific cases at hand—and the broader issue of government regulation of automotive safety.

Does NHTSA Have Enough Resources for Defects Investigation?

Some Members of Congress and consumer groups have suggested that NHTSA lacks the resources to effectively carry out its responsibility to detect automotive defects. Joan Claybrook, a former head of NHTSA, says the agency's budget and staffing were reduced by almost one-third during the 1980s, and have never been restored to earlier levels.⁶¹ However, while that may be true of NHTSA as a whole, it does not necessarily apply to the defects investigation work of NHTSA. NHTSA's budget for defects investigation, adjusted for inflation, was larger in FY2010 (at \$9.8 million) than in FY1981 (\$4.7 million).⁶² The number of staff dedicated to defects investigation has increased to 57 in FY2010 from 45 in FY2000, following passage of the TREAD Act.⁶³

Whether NHTSA's budget for defects investigation is sufficient for protecting the public from unreasonable safety defects is another question. No specific evidence has been cited in support or in contradiction of the claim that NHTSA lacks sufficient staff resources to conduct needed investigations. Some have pointed to NHTSA's repeated reference, in declining to open defect investigations after examining defect petitions, or in terminating defect investigations without having identified a safety defect, to its "need to make effective use of limited resources," suggesting that language indicates that NHTSA does not have sufficient resources.⁶⁴ But the reference to making effective use of limited resources is an acknowledgement that, at some point during an investigation, if no defect has been identified, the investigation needs to be concluded so that investigators can turn to other investigations.⁶⁵

⁶¹ Joan Claybrook, President Emeritus, Public Citizen, testimony before the U.S. Congress, House Committee on Oversight and Government Reform, *Hearing on Toyota Gas Pedals: Is the Public at Risk?*, February 24, 2010.

⁶² NHTSA's operations & research budget (i.e., its budget for activities other than safety grants to states) for the period FY1976-1989 peaked, in real terms, in FY1981, so the defects investigation budget for that year was used as the basis for comparison. The 1981 figure was taken from NHTSA's FY1982 budget estimate, and was converted to 2010 constant dollars using the GDP chained price index figures in Table 10.1—Gross Domestic Product and Deflators Used in the Historical Tables: 1940-2015, in Office of Management and Budget, *Budget of the United States Government FY2011: Historical Tables*, pp. 210-211.

⁶³ FY2000 staffing: Office of the Inspector General, Department of Transportation, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, p. 34.

⁶⁴ House Committee on Oversight and Government Reform hearing, "Toyota Gas Pedals: Is The Public at Risk," February 24, 2010.

⁶⁵ To demonstrate that a suspected safety defect exists in a vehicle, an investigation need only find an instance of that defect. It is impossible to prove that a suspected defect does not exist in a vehicle, since to do so an investigation would have to explore every possibility under which that defect might appear. In a machine as complex as a car, the number (continued...)

The DOT Inspector General, in a 2002 review, questioned the limited amount of time staff had to assess consumer complaints. In its review, the DOTIG estimated that the staff responsible for reviewing the roughly more than 34,000 annual complaints had “an average of about 12 minutes per complaint to review the information, search the defect database for similar complaints, related investigations, and recalls, and decide whether to recommend an investigation.”⁶⁶ The DOTIG report also noted that the complaint database was filled with errors. This problem appears to persist: one group that reviewed NHTSA’s complaints found the complaint database “a mess. After reading each complaint since model-year 2005, we found that 30 percent of the original complaints were miscategorized; more than 26 percent were duplicates.”⁶⁷ NHTSA reports that currently all complaints are initially screened and entered into NHTSA’s complaints database by a pair of screeners. These two screeners’ responsibilities include categorizing the complaints for further review by a group of six screeners with various areas of expertise who review complaints that fall into their specialties.

DOT officials have testified that the Administration’s FY2011 budget requests 66 additional positions for NHTSA.⁶⁸ They have not indicated how many of these new positions might be dedicated to defects investigations, saying that the allocation of the positions within NHTSA will be based on need. NHTSA’s FY2011 Budget Estimate shows that the requested FY2011 funding for Safety Defects Investigations is the same amount enacted for FY2010: \$9.829 million.⁶⁹ The total FY2011 budget request for NHTSA was \$878 million, \$5 million more than the FY2010 enacted level. Most of NHTSA’s funding (71%—\$620 million of the \$873 million total for FY2010) is distributed to states in the form of grants to support traffic safety activities. Driver behavior programs are implemented by the states, not the federal government, which is why most of NHTSA’s funding goes to states’ efforts to change driver behavior.

NHTSA’s mandate is the promotion of auto safety, usually measured by the reduction of traffic deaths and injuries. The vast majority of traffic deaths and injuries result not from vehicle safety defects, but from driver behavior: driving while intoxicated, driving while distracted, speeding, vehicle occupants not wearing seat belts, motorcyclists not wearing helmets.⁷⁰ **Table 2** indicates the relative scale of crashes and fatalities possibly attributed to reports of sudden acceleration in Toyotas in the context of traffic deaths from all causes. Some people contend that NHTSA’s defects investigation resources should be increased in order to promote traffic safety; other observers contend that any additional resources would have a greater impact on safety if applied toward driver behavior programs.

(...continued)

of combinations of variables that would have to be explored is vast, and the circumstances under which a defect might appear could be extremely rare; consequently, investigations could continue interminably.

⁶⁶ United States Department of Transportation, Office of Inspector General, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, p. 11, <http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2002071.pdf>.

⁶⁷ Jeremy Anwyl, chief executive of Edmunds.com, “No easy answer for the Toyota problem,” *Washington Post*, March 16, 2010, p. A19.

⁶⁸ John D. Pocari, Deputy Secretary of Transportation, testimony before the Senate Commerce, Science and Transportation Committee, March 4, 2010, http://commerce.senate.gov/public/?a=Files.Serve&File_id=82413f20-2420-4463-a663-72ed299bf55a.

⁶⁹ United States Department of Transportation, NHTSA, *FY 2011 Congressional Budget Justification*, p. 54, <http://www.dot.gov/budget/2011/budgetestimates/nhtsa.pdf>.

⁷⁰ U.S. General Accounting Office, *Highway Safety: Research Continues on a Variety of Factors that Contribute to Motor Vehicle Crashes*, GAO-03-436, March 2003, p. 7, <http://www.gao.gov/new.items/d03436.pdf>.

Table 2. Scale of Toyota Sudden Unintended Acceleration Incidents

Data for Toyota, 2000-2010; Totals 2000-2008

	Attributed to Sudden Unintended Acceleration in Toyota Vehicles	Total from All Causes
Crashes involving Fatalities	43	340,152
Resulting Fatalities	52	377,604
Resulting Injuries	38	NA

Source: Toyota data: NHTSA, cited in “Toyota Sudden Acceleration Tied to 43 Fatal Crashes,” by Angela Greiling Keane and Jeff Plungis, Bloomberg.com, March 2, 2010; Total crashes and fatalities: NHTSA, *Traffic Safety Facts 2008*, Tables 1 and 2.

Notes: The *Traffic Safety Facts* report has figures for both deaths and injuries that result from crashes, but does not report a number for the subcategory of injuries that resulted only from those crashes that also involved fatalities.

Another point raised in connection with the Toyota issue is that NHTSA may not have the right mix of investigative expertise. Specifically, in view of the increasing role of electronics and computer software in automobiles, the question has been raised as to whether NHTSA has sufficient numbers of electrical and software engineers for its investigations. NHTSA officials have testified that they have five electrical engineers on staff, plus another electrical engineer and a software engineer at the Vehicle Research and Test Center in East Liberty, OH.⁷¹ Subsequent information from NHTSA indicates that two of the electrical engineers work in the Office of Defects Investigation, whose staff includes a total of 26 engineers.⁷²

Is the Toyota Issue a Sign of Broader Problems Within the Auto Industry?

In general, contemporary cars are safer and more reliable than ever before.⁷³ But as a result of these improvements, cars are also more complex than ever. As **Table 3** indicates, the number of automotive recalls per year has generally been increasing, although the number of vehicles, tires, and equipment affected by these recalls has been declining. Most recalls are initiated by manufacturers, not in response to NHTSA action.

⁷¹ David Strickland, NHTSA Administrator, Testimony before the U.S. Congress, Senate Committee on Commerce, Science, and Transportation, *Hearing on the Government Response to the Toyota Recalls*, 111th Cong., 2nd sess., March 2, 2010.

⁷² Personal communication from NHTSA, March 16, 2010.

⁷³ Simanaitis, Dennis, “Add More Lightness—Technical Report,” *Road & Track*, February 11, 2010, p. 2, http://www.roadandtrack.com/auto_news/tech/add-more-lightness/page_2_-_add_more_lightness_page_2; and “R&T Safety Glossary—Technical Report,” *Road & Track*, March 15, 2010, http://www.roadandtrack.com/auto_news/tech/r-t-safety-glossary.

Table 3. Motor Vehicles and Equipment Defect Recall Trends
Total Defect Recalls and NHTSA-Influenced Defect Recalls

Period	Total Defect Recalls		NHTSA-Influenced Defect Recalls			
	Average Annual # of Recalls	Average Annual # of Items Affected	Average Annual # of Recalls	Average Annual # of Items Affected	% of Recalls	% of Items Affected
1995-1999	306.8	23,605,522	80.4	12,249,817	26.2%	51.9%
2000-2004	485.8	25,739,544	95.6	15,765,715	19.7%	61.3%
2005-2009	524.4	17,078,418	118.6	8,627,948	22.6%	50.5%

Source: Data from NHTSA, Recall Management Division, updated as of January 11, 2010.

Notes: "Items Affected" includes vehicles, auto equipment (e.g., tires), and child safety seats.

The trend of increasing numbers of recalls is seen in other countries as well. For example, a study of recall actions in the United Kingdom found that the number of recalls per year rose between 1992 and 2002.⁷⁴ The reason(s) for the increasing number of recalls is not clear. Among the explanations that have been proposed are, for example, that (1) the increasing complexity of automobiles, combined with a quicker product development cycle in the automotive industry, are resulting in cars coming to market with more safety-related problems than in the past; and (2) that safety-related defects are no more frequent than in the past, but concerns about lawsuits and greater scrutiny have made manufacturers more inclined to recall vehicles for issues that earlier might have been ignored.

Are Electronics and Software Testing Stringent Enough?

An emerging issue for lawmakers and investigators is the possibility of problems arising from (1) glitches with software used to run onboard systems, (2) problems in computer hardware, or (3) issues regarding internal electronic compatibility and outside electromagnetic interference that can impede the performance of automobiles.

Electronics

Automobile manufacturers perform multiple tests of their products to ensure that the electronic systems in their vehicles work as intended. In general, automotive companies have developed standards, equipment, and techniques to test whether electronic systems are vulnerable to a range of possible forces that could impair their operation:

- The inner workings of the automobile—each vehicle has internal electronic components that have their own circuitry and could potentially create interference. The auto ignition system is one major energy source.⁷⁵

⁷⁴ Bates, Hilary, Matthias Holweg, Michael Lewis, Nick Oliver, "Motor Vehicle Recalls: Trends, Patterns, and Emerging Issues," *Omega*, 35 (2) (April 2007), pp. 202-212.

⁷⁵ Yi Sun and Chaoqun Jiao, *The Current State of Automotive Electromagnetic Compatibility Research*, Department of Electrical Engineering, Jinging Jiatong University, China., Progress in Electromagnetics Research Symposium, Beijing, China, March 27-29, 2009, <http://piers.mit.edu/piers2k9beijing/programfinal.php>.

- Static interference—as an automobile moves down the road, for example, it experiences high-speed friction with the surrounding air that can produce static electricity.
- Outside interference—a traveling car or truck passes a variety of outside electromagnetic forces such as high-voltage transmission lines or television and radio communication equipment.⁷⁶

According to Todd Huber, professor of vehicle electronics at the Clemson University International Center for Automotive Research, most automobile manufacturers carry out component- and vehicle-level testing of electronic systems. Most of the relevant tests are based on international standards, many of which began as standards created by the SAE International, an association of engineers and technical experts in aerospace, automotive, and commercial-vehicle industries. The electronics standards are usually voluntary and are not legal requirements. Manufacturers often have their own standards, which Huber says may differ from the international standards.⁷⁷ Clemson has compiled a list of relevant automotive electronics standards.⁷⁸

Toyota has eight special test chambers for electronics in Japan. The company began building a testing chamber in Michigan two years ago, though it will not be completed for another two years. Toyota engineers say they test their components based on European Union, Society of Automotive Engineers, or international standards. For example, for testing potential interference from low-frequency electronic devices, the company uses EU standards.⁷⁹ The company also has its own standards.

Software

Software applications were first introduced into car ignition systems 30 years ago. Today, electronics and software can account for 40% or more of the production cost of a car, and a high-end automobile can require more than 10 million lines of computer code to run hundreds or thousands of individual functions and dozens of electronic components.⁸⁰ Some cars, with global positioning systems, wireless communications, cruise control, automatic parking control, and a slew of engine-related functions, have software code that begins to rival that of more sophisticated equipment, like aircraft.

Automobile manufacturers procure parts from outside suppliers, and then create finished vehicles assembly-line style. Some experts say that such a system may not be optimal for vehicles that

⁷⁶ Ibid.

⁷⁷ Information from Professor Todd Huber, March 10, 2010.

⁷⁸ The Clemson University Vehicular Electronics Laboratory, Automotive Electronic Compatibility (EMC) Standards, CISPR (Automotive Emissions Requirements), http://www.cvel.clemson.edu/auto/auto_emc_standards.html. According to the Alliance of Automobile Manufacturers, which represents major U.S. and foreign auto companies, three of the most important electronic guidelines include International Organization for Standardization standards 11451, 11452, and 7637. The European Union also has some mandatory directives.

⁷⁹ Toyota Motor Sales, 2010 Toyota Electronic Throttle Control Webinar, February 22, 2010, <http://pressroom.toyota.com/pr/tms/2010-toyota-electronic-throttle-154266.aspx>.

⁸⁰ Broy, Manfred, *Challenges in Automotive Software Engineering*, Institut für Informatik, Technische Universität München, 2006. International Conference on Software Engineering, Shanghai, China, May 20-28, 2006, <http://www.irisa.fr/lande/lande/icse-proceedings/icse/p33.pdf>.

now contain dozens of data processors that control thousands of software functions and where phenomena like unintentional interaction between different software and hardware components can become issues.⁸¹ Long-term reliability data may not be available for some software.⁸² Owners may not service their cars as frequently and rigorously as recommended, though software is designed to alert drivers to needed tuneups or unexpected problems with the automobile.⁸³ Auto companies try to design their products to account for tough driving conditions.

Auto manufacturers have experienced glitches with software. For example, Toyota in February 2010 announced it was recalling certain models of its Prius-make vehicles to update software controlling the anti-lock braking system.⁸⁴ Other auto companies have recalled millions of cars for software flaws ranging from problems with air bag deployment to the failure of software controlling onboard music and other entertainment systems.⁸⁵ Some experts point out that while there have been high-profile cases of automobiles recalled for software problems, mechanical flaws remain a much larger problem for the industry.⁸⁶

Software development is becoming an increasingly expensive area for auto manufacturers, which is leading to expanded efforts to increase standardization. Another factor influencing industry moves to systematize elements of software design is heightened safety concern as onboard computers begin to carry out functions that more directly affect the control of an automobile.⁸⁷ Vehicles have advanced from single-control devices like airbags, to braking systems where several components are linked into a network to systems that use several computer networks and also are also linked to systems outside the car through a radio, for example.⁸⁸

Automobile manufacturers use a variety of standards in developing software, including guidelines developed by the Motor Industry Software Reliability Association (MISRA), an international automotive industry association based in the United Kingdom.⁸⁹ The MISRA guidelines are designed to ensure that software code is standardized and dependable and also offers guidance on safety analysis.⁹⁰ The MISRA guidelines are widely used in other transportation systems, including aviation and railroads.

⁸¹ Ibid.

⁸² Ibid. Broy noted data indicating that as many as half of the Electronic Control Units that mechanics replace in cars are technically error free—they are removed because mechanics could not find a better way to fix the problem.

⁸³ Personal communication with the Alliance of Automobile Manufacturers, April 7, 2010.

⁸⁴ Toyota Motor Sales, “Toyota Announces Voluntary Recall on 2010 Model-Year Prius to Update ABS Software,” Press Release, February 8, 2010.

⁸⁵ Wharton School of Business, “Car Trouble: Should We Recall the U.S. Auto Industry?” *Knowledge@Wharton*, May 4, 2005, http://knowledge.wharton.upenn.edu/printer_friendly.cfm?articleid=1183.

⁸⁶ Ellims, Michael, Pi Technology, “On Wheels, Nuts and Software,” 2004, *Conferences in Research and Practice in Information Technology*, Vol. 47. Paper prepared for 9th Australian Workshop on Safety-Related Programmable Systems.

⁸⁷ Ibid. Grimm, Klaus, “Software Technology in an Automotive Company—Major Challenges,” 25th International Conference on Software Engineering (ICSE’03), May 2003, p. 498.

⁸⁸ Grimm, Klaus, “Software Technology in an Automotive Company—Major Challenges,” 25th International Conference on Software Engineering (ISCE’03), May 2003, p. 498.

⁸⁹ Hill, Chris, “Making the Most of MISRA C++,” *embeddednews.co.uk*, http://www.embeddednews.co.uk/ArticleItem.aspx?Cont_Title=Making+the+most+of+MISRA.

⁹⁰ Tapp, Chris, Keylevel Consultants Ltd., “An Introduction to MISRA,” Presentation at University of Warwick, June 2007.

The Society of Automotive Engineers recently announced enhanced software guidelines, including the creation of a repository for information about the industry, best practices for software design, and criteria for evaluating industry compliance with best practices.⁹¹ Manufacturers will be able to access the repository, when it is up and running, for information on the credentials of designers working in various areas. The repository will also allow companies to share data.

Another industry effort is Autosar, or Automotive Open System Architecture, which was formed in 2003. Autosar is a global coalition of automobile manufacturers, suppliers and electronics, semiconductor, and software firms working to develop standardized software for the auto industry. The group's "core partners" include BMW Group, Bosch, Daimler, Ford, General Motors, Toyota, and Volkswagen. Autosar describes its mission as "simplifying the exchange and update options for software and hardware" to control the complexity of electrical and electronic systems in motor vehicles.⁹² The industry group says increased standardization should reduce costs over the long run, allow companies to focus more on specific high-end applications and make it easier for suppliers to create products that can be used across the industry.

Electronic Throttle Problems

While Toyota and NHTSA have identified two mechanical causes for the sudden acceleration—improperly designed floor mats and "sticky" accelerator pedals—some automotive experts and lawmakers say officials have been too quick to dismiss the possibility that the cars' electronics systems could be a factor.

Electronic throttle control, often described as drive-by-wire, is a system where sensors, rather than a mechanical cable or rods attached to an accelerator, are used to control the throttle. In such systems, the sensors send signals to onboard computers that determine how far to open the throttle, which determines air flow and fuel usage. The system, by improving efficiency, can increase mileage and reduce emissions and provide faster response time and better maneuverability.⁹³

Electronic throttles are engineered with redundant components in an effort to create a reliable, fail-safe system and prevent unintended acceleration or other potential problems. Toyota says its system is designed with multiple layers of technology that should protect a driver in case of unanticipated difficulties. For example, Toyota accelerators and throttles each have two sensors that must work together for the car to operate. In the case of a serious malfunction, the vehicle is engineered to revert to idle mode.⁹⁴ Automakers install indicator lights that illuminate in the event of a potential malfunction, alerting a driver of a potential problem. In many cases, according to automakers, the onboard computer controlling the throttle also receives a diagnostic trouble code

⁹¹ Information from the Society of Automotive Engineers. The guidelines create a SAE Software Assessment Repository, which is a Web-based system that allows organizations that develop embedded automotive software to pose and share data. The repository does not mandate using one assessment other over another.

⁹² Autosar, FAQ, <http://www.autosar.org/index.php?p=1&up=6&uup=0>.

⁹³ Mauser, Hans and Erwin Thurmer, *Electronic Throttle Control—A Dependability Case Study*, Journal of Universal Computer Science, vo. 5. No. 10, November 28, 1999, http://www.jucs.org/jucs_5_10/electronic_throttle_control_a/Mauser_H.pdf.

⁹⁴ Toyota Motor Sales, 2010 Toyota Electronic Throttle Control Webinar, February 22, 2010, <http://pressroom.toyota.com/pr/tms/2010-toyota-electronic-throttle-154266.aspx>.

when a problem is detected. The code is stored in the computer memory, aiding in repair of the vehicles or in reconstruction of events leading up to an incident.

Some automobiles include a brake override system that essentially halts power to the car if the accelerator and brake pedal are both depressed at the same time. Toyota is installing the brake override software in autos brought back on recall, if the particular vehicle is equipped to receive the update. Toyota will start installing the equipment as a standard feature on 2011 model year vehicles.⁹⁵

While NHTSA and Toyota have not to date discovered a problem with the electronics in the cars they have tested for sudden acceleration, they are expanding their investigations. Specifically, the DOT has asked the National Research Council (NRC) to spend 15 months looking at both instances of unintended acceleration and to examine electronic vehicle controls across the entire automotive industry. The effort will include a review of previous industry and government efforts to identify possible sources of unintended acceleration as well as automotive software and computer hardware design, electromagnetic compatibility, and potential electromagnetic interference. The panel is to make recommendations on how to improve auto safety in these areas.⁹⁶

NHTSA's separate review of electronic throttle controls in Toyotas, aided by NASA engineers, is expected to be completed by late summer 2010. The DOT has announced that nine NASA experts will aid NHTSA, and more could join the effort if necessary. Some outside experts have already performed their own analysis of Toyota engineering. Toyota is pushing back, for example, against a study by Southern Illinois Professor David Gilbert in which he said he had discovered a flaw in the electronics of a Toyota vehicle that could lead to unintended acceleration.⁹⁷ Toyota on March 8, 2010, charged that Gilbert had rewired and re-engineered the car in ways that were "virtually impossible to occur in real-world conditions." Toyota officials announced that they had been able to produce similar results on automobiles manufactured by other companies, using Gilbert's techniques.⁹⁸

⁹⁵ Yoshimi Inaba, President and COO Toyota North America and Chairman and CEO of Toyota Motor Sales, testimony to the Senate Committee on Commerce, Science and Transportation, March 2, 2010.

⁹⁶ U.S. Department of Transportation, "U.S. Transportation Secretary Ray LaHood Announces Major Investigations to Resolve Issue of Sudden Acceleration," Press Release, March 30, 2010.

⁹⁷ Gilbert, David W., *Toyota Electronic Throttle Control Investigation: Preliminary Report*, February 21, 2010, http://energycommerce.house.gov/Press_111/20100223/Gilbert.Testimony.pdf.

⁹⁸ Toyota Motor Sales, "Comprehensive Analysis Raises Concerns about Gilbert Testimony, ABC News Segment," March 8, 2010, Web cast.

Congressional Options

Congress in February 2010 began a series of hearings on the issue of unintended acceleration in Toyota vehicles. Lawmakers have requested thousands of pages of documents from Toyota and NHTSA, and have indicated that they plan to hold additional hearings. As part of the congressional examination, lawmakers are examining the actions of Toyota and NHTSA in the period leading up to the recent, extensive recalls.

Senate Commerce Committee Chairman Jay Rockefeller of West Virginia has laid out possible steps for Congress and the DOT, including taking a fresh look at the TREAD Act, requiring brake override technology on all new automobiles, requiring auto makers to provide the necessary equipment for investigators to read electronic data recorders and forcing senior executives of auto companies to personally certify that information their firms provide to NHTSA is complete and accurate.⁹⁹

Secretary of Transportation Ray LaHood also has raised the possibility of requiring brake override systems in all new cars, and has suggested that Congress tighten lobbying laws and regulations to make it more difficult for former officials to lobby their former agencies. The DOT has pulled in NASA engineers to take a closer look at potential issues with electronics and is continuing to assess whether Toyota has reported possible product defects in an expeditious manner, as required by law.

Consumer advocates have suggested broader changes including new standards for accelerators and electronics testing; mandatory installation of event data recorders and the collection of more information; more public disclosure of Early Warning Reports under the TREAD Act; higher fines for violations of the TREAD law; and enhanced funding for NHTSA.¹⁰⁰

⁹⁹ Statement of Sen. Rockefeller at March 2, 2010, Senate Commerce, Science and Industry Committee hearing on Toyota recalls.

¹⁰⁰ Testimony of Clarence Ditlow, Executive Director of the Center for Automotive Safety, before the Senate Commerce, Science and Industry Committee, March 2, 2010. Joan Claybrook, President Emeritus, Public Citizen, testimony before the U.S. Congress, House Committee on Oversight and Government Reform, *Hearing on Toyota Gas Pedals: Is the Public at Risk?*, February 24, 2010.

Appendix A. NHTSA and the TREAD Act

In October 2000, Congress passed the TREAD Act (P.L. 106-414). The act was passed in response to a safety problem involving certain Firestone tires, which were linked to a number of crashes and deaths, and which led to a recall of millions of tires. During hearings on this issue, Congress examined why NHTSA had not spotted the tire problems sooner, and whether there were changes that could help NHTSA more quickly identify possible safety defects. Congress concluded that NHTSA did not have sufficient information to identify the problem with the tires, but also that NHTSA had not made effective use of the limited information it did have.¹⁰¹ In the TREAD Act, Congress authorized provisions to increase both the amount of data available to NHTSA to help it to identify potential safety defects, and resources to improve NHTSA's capacity to analyze data to more quickly identify possible defects.

Increasing Potential Defect Information Available to ODI

Section 3 of the TREAD Act included new reporting requirements for motor vehicle and equipment manufacturers. One provision required manufacturers to inform NHTSA of safety recalls or other safety campaigns conducted in foreign countries on motor vehicles or equipment similar to those sold in the United States. The law also gave manufacturers an obligation to notify NHTSA within five days of determining whether a defect exists. A key provision was the Early Warning Reporting (EWR) requirement (section 3(b)). The EWR requires manufacturers to regularly share with NHTSA certain information they receive about their vehicles or equipment. Specifically, manufacturers are required to report on a quarterly basis

1. The number of vehicles, tires, and child restraint systems, by make, model, and model (production) year, that were produced;
2. The number of claims and notices involving death (including those in foreign countries), personal injury, and property damage by make, model, model year, and vehicle identification number;
3. The number of paid warranty claims in the United States that involve specified components and systems;
4. The number of field reports received from the manufacturer's employees, representatives, dealers, and fleets, related to problems with specified components and systems, and copies of all field reports (except those from dealers); and
5. All consumer complaints received regarding a product.

Prior to the implementation of the EWR requirement, NHTSA's primary information sources for potential vehicle safety defects were technical service bulletins from manufacturers, recalls conducted by manufacturers, and complaints by consumers directly to NHTSA, as well as NHTSA's own defect investigations. While NHTSA was receiving 40,000 to 50,000 consumer

¹⁰¹ United States Department of Transportation, Office of Inspector General, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, p. 1, <http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2002071.pdf>.

complaints each year, that was a small fraction—on the order of 10%—of the number of complaints that were received by manufacturers themselves.¹⁰²

One issue that arose during implementation of the EWR provision was the question of to what extent NHTSA would make public the data provided by manufacturers. An auto equipment industry group sued to require NHTSA to withhold all manufacturer data except when an investigation was initiated, on the grounds that the information could subject companies to competitive harm, and that it was not the intention of Congress that such data should be made public. Conversely, a public safety group sued to require NHTSA to make all of the data available, on the grounds that safety defects could be more effectively identified if the public was also able to view all the information. NHTSA took a middle course. It makes certain data it receives from the manufacturers publicly available (light vehicle production numbers and death, injury, and property damage incidents by make, model, model year, and reported components involved), while keeping other data confidential (e.g., warranty claims, consumer complaints to the manufacturer, field reports).¹⁰³ NHTSA's reasoning was that too much disclosure could create a competitive disadvantage for manufacturers (by providing certain information to competitors), and could impair NHTSA's ability to obtain similar information in the future (since manufacturers might limit their information-gathering efforts if they were required to disclose all that information).¹⁰⁴

Increasing ODI's Capacity to Analyze Potential Defect Information

After passage of the TREAD Act, NHTSA replaced the ODI's defects information system with a new system, ARTEMIS (Advanced Retrieval (Tire, Equipment, Motor Vehicle) Information System). ARTEMIS was conceived as an information system that could both compile the greatly increased amounts of information NHTSA would receive as a result of the EWR requirement and provide sophisticated data-mining capacities for analysis of this information.

ARTEMIS's initial 21-month completion schedule stretched to 42 months; its budget nearly doubled (from \$5.35 million to \$9.4 million); and when it was fully deployed in July 2004, it lacked some of the "more advanced trend and predictive analyses [capabilities] that were originally envisioned as being needed to identify defects warranting investigation."¹⁰⁵ One example of a missing feature in ARTEMIS was the system's lack of ability to automatically highlight trends such as increases in the number of complaints and warranty claims related to a specific motor vehicle component.¹⁰⁶

¹⁰² United States Department of Transportation, Office of Inspector General, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, p. 11, <http://www.oig.dot.gov/sites/dot/files/pdffdocs/mh2002071.pdf>.

¹⁰³ United States Department of Transportation, National Highway Traffic Safety Administration, *Public Release of EWR Data*, (no date, but cites a change beginning September 10, 2008), <http://www-odi.nhtsa.dot.gov/ewr/qb/documents/NHTSA-ODI-EWR-Facts.pdf>.

¹⁰⁴ United States Department of Transportation, Office of the Inspector General, *Follow-Up Audit of the Office of Defects Investigation*, MH-2004-088, September 23, 2004, pp. 16-17, <http://www.oig.dot.gov/sites/dot/files/pdffdocs/mh2004088.pdf>.

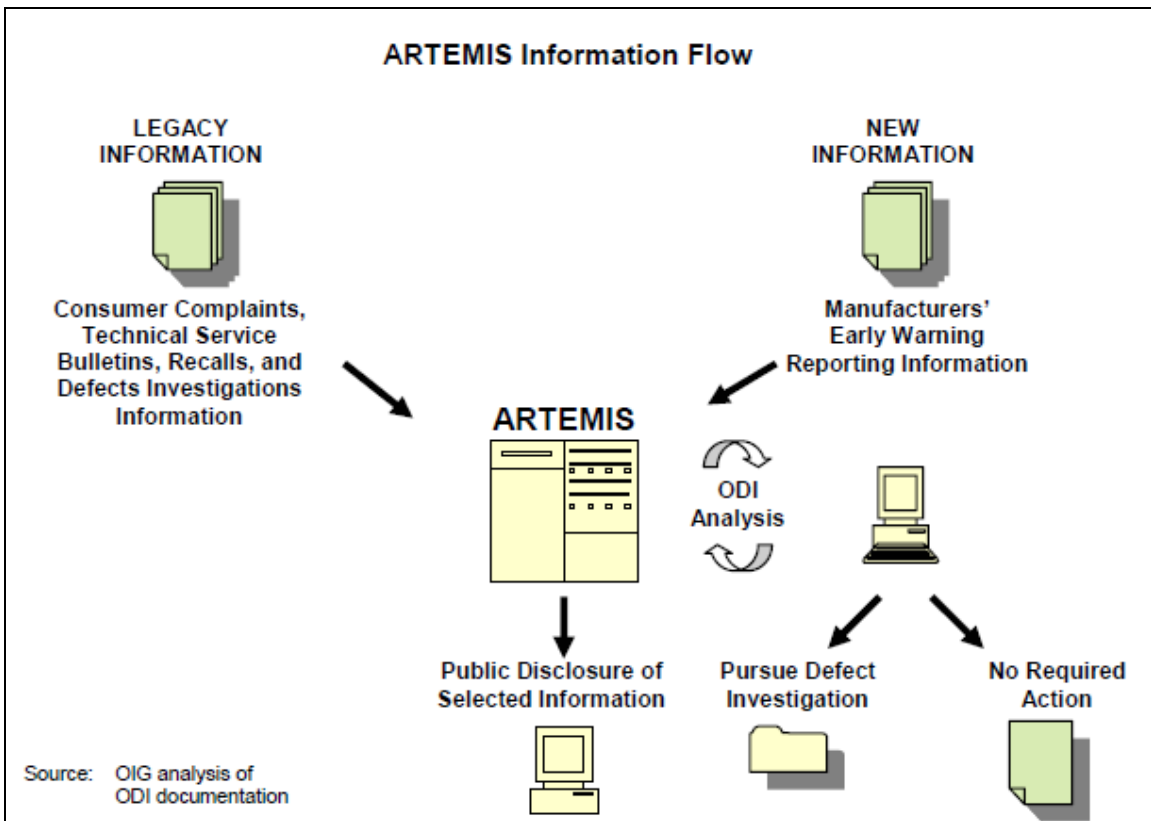
¹⁰⁵ United States Department of Transportation, Office of the Inspector General, *Follow-Up Audit of the Office of Defects Investigation*, MH-2004-088, September 23, 2004, p. 14, <http://www.oig.dot.gov/sites/dot/files/pdffdocs/mh2004088.pdf>.

¹⁰⁶ United States Department of Transportation, Office of the Inspector General, *Follow-Up Audit of the Office of Defects Investigation*, MH-2004-088, September 23, 2004, pp. 16-17, <http://www.oig.dot.gov/sites/dot/files/pdffdocs/> (continued...)

In its 2004 audit, the DOT IG was told by NHTSA that it was considering the use of other software to supplement the analytical capacities of ARTEMIS, and also that NHTSA had signed an agreement with the Federal Aviation Administration (FAA) to the effect that the FAA would help NHTSA develop a system to review EWR reports from manufacturers and to identify advanced data analytical options that might be employed.¹⁰⁷ CRS has been unable to obtain updated information about the status of these efforts.

Elements of ARTEMIS are available to the public for searching some EWR information (see <http://www-odi.nhtsa.dot.gov/ewr/>). According to NHTSA, there are over 9,500 unique visitors to the ARTEMIS site each day.¹⁰⁸ See **Figure A-1** for an illustration of the information inputs for ARTEMIS.

Figure A-1. ARTEMIS Information Inputs



Source: United States Department of Transportation, Office of the Inspector General, *Follow-Up Audit of the Office of Defects Investigation*, MH-2004-088, September 23, 2004, p. 28, <http://www.oig.dot.gov/sites/dot/files/pdffdocs/mh2004088.pdf>.

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mh2004088.pdf.

¹⁰⁷ United States Department of Transportation, Office of the Inspector General, *Follow-Up Audit of the Office of Defects Investigation*, MH-2004-088, September 23, 2004, p. 14, <http://www.oig.dot.gov/sites/dot/files/pdffdocs/mh2004088.pdf>.

¹⁰⁸ United States Department of Transportation, National Highway Traffic Safety Administration, *FY 2011 Congressional Budget Justification*, p. 292, <http://www.dot.gov/budget/2011/budgetestimates/nhtsa.pdf>.

Appendix B. NHTSA's Defects Investigation Process

NHTSA's defects investigation process has several stages, with points where a decision to begin or continue an investigation is made (see **Figure B-1** and the summary below). In a 2002 review the DOTIG examined a random sample of 59 defect cases that were either recommended for, or led to, investigation. Of those 59 cases, 21 began immediately as investigations, bypassing the defect analysis/investigation recommendation stage. The remaining 38 cases were recommended for investigation. Investigations were opened for 28 of the cases. At the time those decisions were made, there was no process for recording the reasons why investigations were not undertaken. ODI officials were able to provide reasons why at least some of the cases did not lead to investigations. But the DOTIG found no consistent differences between the cases that led to investigations and those that did not.¹⁰⁹

The DOTIG noted that ODI defect cases for which defects analysts recommended an investigation be started but for which investigations were not started remain open for monitoring. However, the DOTIG observed that there was no system for tracking whether such cases were in fact continuing to be monitored (e.g., no status or progress reports were required). As a result, ODI managers did not know whether staff continued to search for new complaints related to those cases, or whether new information suggested that a case should be re-evaluated for investigation. The DOTIG review identified subsequent complaints in 7 of 10 cases randomly sampled, and found significant increases in the number of complaints received in two of those cases. ODI had not opened an investigation for any of the 10 cases.¹¹⁰

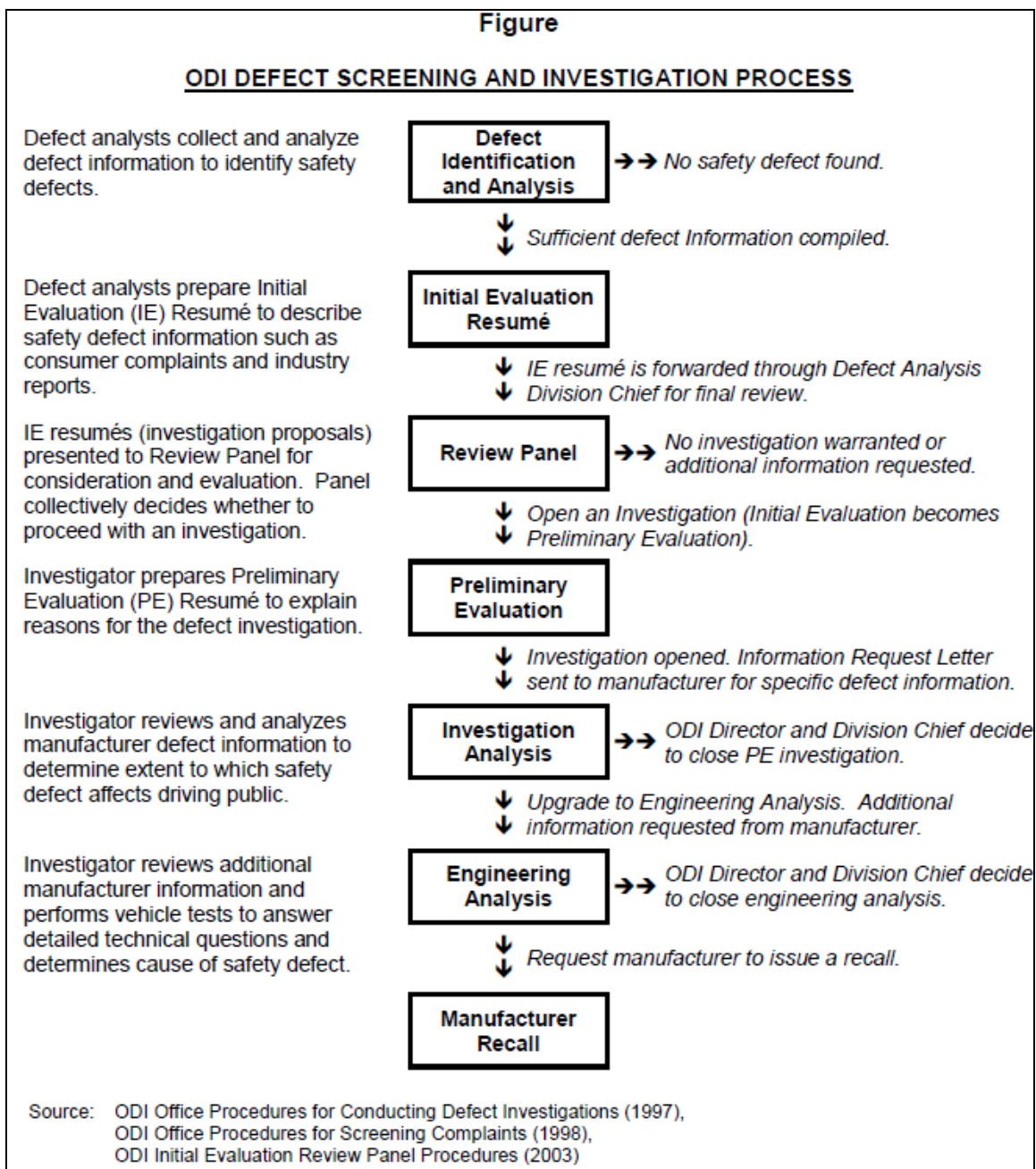
Receiving Information About Potential Defects

The Office of Defects Investigation (ODI) receives information about possible defects through several channels. It maintains a toll-free hotline (888-327-4236) and an online site (<http://www.safercar.gov>) through which consumers can report complaints about motor vehicles. Consumers can also mail a letter or fax information to the ODI. NHTSA has a form on its website to help elicit information from complainants. NHTSA's website tells visitors that there are four categories for safety complaints: motor vehicles, tires, non-original vehicle equipment (e.g., lights, jacks, wipers, etc.), and child restraint equipment. NHTSA also receives EWR information from manufacturers. This information is entered into the ARTEMIS information system for analysis.

¹⁰⁹ United States Department of Transportation, Office of Inspector General, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, pp. 14-16, <http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2002071.pdf>.

¹¹⁰ United States Department of Transportation, Office of Inspector General, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, p. 17, <http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2002071.pdf>.

Figure B-1. ODI Defects Investigation Process



Source: United States Department of Transportation, Office of the Inspector General, *Follow-Up Audit of the Office of Defects Investigation*, MH-2004-088, September 23, 2004, p. 38, <http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2004088.pdf>.

Defects Analysis and Identification

Complaints are assessed by NHTSA's Defects and Recall Information Analysis Division. In 2004, the DOTIG reported that the process of analyzing information for evidence of safety defects can take one to three months. This may include field investigations, surveys, and testing. When a pattern suggesting the possible existence of a safety defect is found, an analyst is to assemble an initial evaluation (IE) package containing pertinent information about the suspected defect. The IE is to be reviewed by the chief of the Defects and Recall Information Analysis Division. The IE is then to be sent to members of a peer review panel two weeks before a regularly scheduled review panel meeting to consider the evaluation. According to NHTSA, on average each analyst evaluates and presents 35 cases of potential defects each year; this number has been increasing over time. (See **Table B-1.**)¹¹¹

Table B-1. Average Number of Issues Evaluated and Presented Per ODI Staff Member

Calendar Year	Average Number of Issues Per Staff Member
2000	15
2002	20
2003	25
2006	28
2007	35

Source: United States Department of Transportation, National Highway Traffic Safety Administration, Budget Estimates for FY2004 (p. 1045-1046), FY2005 (p. 1742, VS-14), FY2006 (1380, III-23), FY2011 (p. 294)

One issue raised by the DOTIG review was the limited amount of time staff had to assess consumer complaints. In its 2002 review the DOTIG estimated that, as ODI was receiving an average of over 34,000 complaints each year, the staff responsible for reviewing those complaints had "an average of about 12 minutes per complaint to review the information, search the defect database for similar complaints, related investigations, and recalls, and decide whether to recommend an investigation."¹¹²

The relatively limited amount of time each screener has to process each complaint, combined with the number of complaints processed each year and the undoubted variety of the information in each complaint, contributes to another challenge identified by the DOTIG that appears to persist. The DOTIG noted in 2002 that the previous version of NHTSA's defects database contained incorrectly recorded information and that the problems identified in complaints in the database did not always reflect all of the information relevant to the potential defect that was included in the complaint.¹¹³

¹¹¹ United States Department of Transportation, National Highway Traffic Safety Administration, *FY 2011 Congressional Budget Justification*, p. 294, <http://www.dot.gov/budget/2011/budgetestimates/nhtsa.pdf>.

¹¹² United States Department of Transportation, Office of Inspector General, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, p. 11, <http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2002071.pdf>.

¹¹³ United States Department of Transportation, Office of Inspector General, *Review of the Office of Defects Investigation*, MH-2002-071, January 3, 2002, p. 11, <http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2002071.pdf>.

Edmunds Automotive in early 2010 did an independent review of the sudden acceleration complaints for all manufacturers contained in NHTSA's current complaints database, and noted that many complaints in the database were miscategorized and many were duplicates.¹¹⁴

NHTSA reports that now all complaints are initially screened and entered into NHTSA's complaints database by a pair of screeners. These two screeners' responsibilities include categorizing the complaints for further review by a group of six screeners with various areas of expertise who review complaints that fall into their specialties. The fact that only two screeners are responsible for the initial handling the 35,000 or more complaints submitted annually may help explain the problems with the quality of the data in the complaints database.

Starting an Investigation

The NHTSA peer review panel is composed of representatives from the defects analysis and vehicle investigation divisions. The panel meets once every two weeks to consider the IEs, which propose that an investigation should be opened. If the review panel decides to proceed with an investigation, analysts in the appropriate vehicle investigation division conduct a preliminary evaluation (PE). If the panel decides not to proceed to an investigation, the reasons why are recorded. On average, around 100 investigations are opened each year.

Stages of Investigation

There are two stages to an investigation: the preliminary evaluation and the engineering analysis.

Preliminary Evaluation (PE)

The PE is based on analysis of additional data obtained from the manufacturer about the potential defect, and may include testing, field investigations, and surveys to determine the number of similar complaints. A PE typically takes four months. A PE may be terminated because the manufacturer initiates a voluntary recall while the PE is underway. At the conclusion of a PE the vehicle investigation division chief and the director of ODI may decide to end the investigation if there does not appear to be evidence of a safety defect, or to proceed to the next stage.

Engineering Analysis (EA)

During the EA, further technical information may be requested from a manufacturer, and further testing, additional field investigations, and more surveys may be done to help determine whether a safety defect exists. An EA can take up to one year.

Given the timing of the elements of a defect identification and investigation, the total defect identification and investigation process can take over a year. NHTSA reports that the average completion time for a defect investigation is eight months.¹¹⁵ That has been the reported average completion time since at least calendar year 2000.¹¹⁶

¹¹⁴ Jeremy Anwyl, Chief Executive, Edmunds.com, "No Easy Answer for the Toyota Problem," *Washington Post*, March 16, 2010, p. A19.

¹¹⁵ United States Department of Transportation, National Highway Traffic Safety Administration, *FY 2011* (continued...)

Recalls

At the conclusion of an EA, the vehicle investigative division chief and the director of ODI may decide to close the investigation, or they may decide that the evidence warrants a safety recall. In that case, NHTSA is to send a letter to a manufacturer requesting that the manufacturer conduct a recall. NHTSA's Defects and Recall Information Analysis Division monitors recalls. However, as noted above, manufacturers may decide to initiate a recall before NHTSA concludes a defect investigation.

As **Table 3** above shows, the average annual number of defect recalls has been increasing over the past 15 years, though the average annual number of items affected¹¹⁷ has decreased in recent years. NHTSA reports that it influences around one-quarter of defect recalls, though the average annual percentage has declined somewhat. Though NHTSA-influenced recalls represent around a quarter or less of the number of recalls, those recalls involve a disproportionate number of items, representing half or more of items affected by defect recalls. A primary mechanism of influence is the opening of a defect investigation; NHTSA reports that approximately 50% of all opened investigations result in a safety recall or other manufacturer action to correct a safety problem.¹¹⁸

(...continued)

Congressional Budget Justification, p. 55, <http://www.dot.gov/budget/2011/budgetestimates/nhtsa.pdf>.

¹¹⁶ This eight-month average figure for calendar year 2000 is referenced in NHTSA's FY2004 budget estimate; the figure is repeated in subsequent budget estimates up through the one for FY2011.

¹¹⁷ "Items affected" includes vehicles, auto equipment (such as tires), and child safety seats.

¹¹⁸ United States Department of Transportation, National Highway Traffic Safety Administration, *FY 2011 Congressional Budget Justification*, p. 55, <http://www.dot.gov/budget/2011/budgetestimates/nhtsa.pdf>.

Appendix C. Toyota Sudden Acceleration Timeline

A timeline of actions related to unintended acceleration in Toyota vehicles.¹¹⁹

- September 2000—Toyota recalls Lexus models in the United Kingdom to prevent floor mats from interfering with gas pedals.
- December 2000—NHTSA received 49,000 consumer complaints for all reasons in 2000, of which about 1,200 or 2% may have claimed unintended acceleration. Of that total, Toyota accounted for 4% of unintended acceleration complaints.
- May, 2003—NHTSA is petitioned to examine unintended, sudden acceleration in the 1997-2000 Lexus LS and GS 4000. After a review, NHTSA denies the petition on the basis that it has found no evidence of a safety defect trend.
- February 2004—NHTSA opens review of electronic throttle control malfunction complaints in 2002 and 2003 models of the Lexus ES300. The investigation is closed in July 2004 after NHTSA identified 20 unique vehicles and two crashes that may have been related to a loss of throttle control, but could not find a vehicle-based cause.
- February/March 2004—State Farm Insurance Co. notifies NHTSA of a trend of rising claims relating to sudden acceleration in the 2002 and 2003 Lexus ES300 and Toyota Camrys.
- August 2005—NHTSA begins investigation of possible uncontrollable acceleration in 2002-2005 model year Camry, Solara, and Lexus ES vehicles. The agency closes the investigation in January 2006 without a determination of a defect.
- July 2006—Toyota tells NHTSA it will conduct a recall of 367,000 Highlander, Lexus RX330, and Lexus RX400h vehicles to fix floor mat retaining clips that may prevent the accelerator pedal from returning to idle.
- September 2006—NHTSA opens investigation of 2002-2006 model year Camrys and Solaras following reports of sudden acceleration. The investigation is concluded without a defect finding.
- 2006—Toyota CEO Katsuaki Watanabe apologizes to consumers for quality problems and the company delays some new models by up to a half year.
- March 2007—NHTSA begins investigation into possible pedal entrapment in 2007 Lexus ES350 based on five complaints alleging three crashes and seven injuries. The agency upgrades the investigation in August 2007 following a fatal crash involving a 2007 Camry. NHTSA in September determines that floor mat entrapment caused the accident and orders a Toyota recall. Toyota recalls 55,000 all-weather floor mats for 2007 and 2008 model year Camry and Lexus ES350 vehicles. NHTSA issues Consumer Advisory warning about the need to properly secure or remove floor mats.

¹¹⁹ Timeline compiled from *Reuters News Service* and *Automotive News*, “Events Leading to Toyota’s Crisis,” February 24, 2010; Toyota Corporate Press Releases; congressional testimony and NHTSA documents.

- April 2008—NHTSA begins investigation into unintended acceleration, due to trim interference, in the 2004 model Sienna minivan. In January 2009 Toyota recalls 26,501 Sienna minivans to fix the carpet.
- August 2009—California Highway Patrolman Mark Saylor and family members are killed in a Santee, Calif. crash of a rental 2009 Lexus ES350. Investigators determine that pedal entrapment by a floor mat may have contributed to the crash and also raise concerns about accelerator pedal design.
- September 2009—NHTSA tells Toyota it expects a recall to address possible defects in pedal design.
- October 2009—Toyota recalls 3.8 million vehicles in the United States to address the possibility that floor mats could trap accelerator pedals in an open position. The recall later is expanded to more than 5 million vehicles in January 2010.
- November 4, 2009—NHTSA issues press release to correct what it terms inaccurate and misleading information by Toyota regarding the recall of the 3.8 million vehicles. Toyota apologizes for having stated that NHTSA had found that “no defect exists.”
- December 15, 2009—NHTSA officials fly to Japan to meet with top Toyota executives to underscore Toyota’s obligations under U.S. law and to prod for faster action on safety issues.
- January 16, 2010—Toyota informs NHTSA that accelerator pedals made by supplier CTS Corp may have a “sticking” defect.
- January 21, 2010—Toyota announces it will recall about 2.3 million Toyota vehicles to fix sticky pedals.
- January 25, 2010—NHTSA tells Toyota it must stop selling vehicles that have acknowledged defects, even if it does not have a remedy.
- January 26, 2010—Toyota announces it will suspend sales and production of eights of its models due to concerns regarding sticking accelerator pedals. The Toyota announcement included the 2009-2010 RAV4, 2009-2010 Corolla, 2009-2010 Matrix, 2005-2010 Avalon, 2010 Highlander, 2007-2010 Tundra, 2008-2010 Sequoia, and some 2007-2010 Camrys. The move did not affect Lexus or Scion vehicles. The decision to cease production affected Toyota plants in Canada, Indiana, Kentucky, and Texas.
- January 29, 2010—NHTSA opens investigation into CTS pedals.
- February 2, 2010—NHTSA renews investigation into Toyota’s electronic throttle system.
- February 4, 2010—NHTSA opens investigation into at least 124 consumer complaints about brakes on Toyota Prius hybrids.
- February 8, 2010—Toyota announced a voluntary recall of about 133,000 model year 2010 Prius vehicles, as well as 14,500 Lexus vehicles in order to update software in the auto braking systems. The company said some owners of the Toyota models in question had reported “experiencing inconsistent brake feel during slow and steady application of the brakes on rough or slick road surfaces.” The company also says it had made changes in the Prius production.

- February 22, 2010—Toyota says it received a federal grand jury subpoena from the Southern District of New York for documents related to unintended acceleration of its vehicles and the Prius braking system. It also disclosed a similar document request from the Securities and Exchange Commission.
- March 2, 2010—Transportation Secretary Ray LaHood tells the Senate Commerce Committee that the Obama Administration is considering requiring brake override systems on all vehicles with electronic throttle controls.

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