# NHTSA's Path Forward

U.S. Department of Transportation
**National Highway Traffic Safety Administration**

# Contents

## Preface

At the National Highway Traffic Safety Administration (NHTSA), each of us knows this number: 32,719. It's the number of Americans who lost their lives on our highways in 2013. We know that number by heart because those people were mothers and fathers, sons and daughters, friends and co-workers. Every one of those lives matter, whether they died in a drunk-driving crash, because of texting at the wheel, from drowsy driving – or from a vehicle safety defect.

NHTSA's system for identifying and addressing defective vehicles came under intense scrutiny in the last year. Much of that scrutiny came from the outside – from Congress, the media, and safety advocates. We welcome the constructive suggestions of those who share our dedication to saving lives. But we have also scrutinized ourselves.

Today, we release the two documents that are the product of our internal scrutiny. Together, they are a blueprint for how we will implement the lessons we learned, and set our defect investigation system on a long-term path for greater effectiveness.

The first document, NHTSA's Path Forward, is the result of the due diligence review NHTSA conducted in the wake of the GM ignition switch recall. It is no overstatement to say this was one of the most significant cases in NHTSA's history, not only because of the tragic toll of deaths and injuries, or the technical challenges it presented, but because of the unprecedented steps the manufacturer took to conceal a deadly defect. NHTSA's Path Forward lays out the lessons NHTSA learned from that episode and how we are changing our processes and practices in response. We're also creating a Safety Systems Team of outside experts to work with us on the implementation of these changes.

The second document, Workforce Assessment: The Future of NHTSA's Defect Investigations, responds to a previous commitment to the U.S. Department of Transportation's Office of Inspector General to assess NHTSA's workforce in light of the breathtaking advances in vehicle technology. The GM ignition switch investigation arose just as NHTSA worked to complete this workforce assessment, and frankly, in light of the fundamental questions the GM case brought up, the original effort was insufficient. So we took the time to get it right. The assessment we release today is a comprehensive examination of the defects investigation system we could build with resources from Congress, one that commits to a vehicle safety system as robust as those that keep our skies and railways safe.

People have asked hard questions of NHTSA in the last year. We have asked hard questions of ourselves. This self-examination has not always been easy. As an agency dedicated to using every tool available to save lives, reduce injuries, and prevent crashes on our roads, this scrutiny provided us an invaluable opportunity to further our safety mission. The passionate, dedicated safety professionals of NHTSA are determined to save lives, and with the release of these documents, we take an important step toward improving our ability to save them.

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## Introduction

On February 7, 2014, General Motors (GM) announced that a safety defect existed in the 2005-2007 model years (MYs) Chevrolet Cobalt and Pontiac G5 vehicles. GM reported that the vehicles had an ignition switch susceptible to being jarred out of the "run" position, potentially causing air bags not to deploy in a crash. The chronology of GM's defect report filed with the National Highway Traffic Safety Administration (NHTSA) made it clear that GM had been aware of the ignition switch problems in the Cobalt as early as 2004, and in the Ion as early as 2001, and that they failed to report the defect until 2014.

Soon after the GM recall went public, U.S. Department of Transportation (DOT) and NHTSA officials met to discuss the implications of the recall. From this discussion, NHTSA set three immediate priorities:

1. Protect the driving public by ensuring that GM quickly recalled and fixed all vehicles that could be affected by this defect;
2. Hold GM accountable for any failure to follow the legal requirement to quickly report and recall the subject vehicles; and
3. Improve NHTSA's ability to find potential defects through (1) a review of the agency's actions and assumptions in this case and (2) an evaluation of the agency's current resources, data, and processes involved in identifying vehicle safety defects.

These priorities led to an in-depth examination of GM's ignition switch defect, as well as the practices of NHTSA's Office of Defects Investigation (ODI), the body within NHTSA responsible for identifying vehicle defects. The intent of this inquiry was to determine what GM and NHTSA each knew about the defect, and then to develop lessons learned to instate process improvements within ODI. This document outlines key findings of the internal NHTSA review and proposes recommendations for constant improvement to NHTSA's defects investigations.



## Due Diligence: Lessons Learned

### Overview of NHTSA's Defects Investigation Process

NHTSA's mission is to "reduce deaths, injuries and economic losses resulting from motor vehicle crashes." NHTSA accomplishes its mission by "setting and enforcing safety performance standards for motor vehicles and motor vehicle equipment, and through grants to State and local governments to enable them to conduct effective local highway safety programs." Within NHTSA, the Office of Defects Investigation (ODI) is responsible for identifying vehicle safety defects.

The defect investigation process, from potential defect detection through opening and conducting a formal investigation, involves several subdivisions of ODI. Two of these–the Defects Assessment Division (DAD) and the Early Warning Division (EWD)–both examine data with the goal of detecting potential defects for investigation, using different, complementary types of information. The three investigating divisions (the Vehicle Integrity Division [VID], the Vehicle Control Division [VCD], and the Medium and Heavy Duty Vehicle Division [MHDVD]) investigate alleged defects through a formal investigation process.

The path to ODI's formal investigation process typically begins with DAD's determination that a potential safety-related defect exists in a vehicle or item of equipment based on DAD's own analysis or a referral from EWD. In such a case, DAD prepares an Initial Evaluation (IE) package for review by a Defects Assessment Review Panel and provides it to the appropriate investigation division for review before the panel is convened. The panel decides either to open a defect investigation or table it for the development of additional information. If a decision is made to open an investigation, the appropriate investigating division opens a Preliminary Evaluation (PE), which is either closed or elevated to an Engineering Analysis (EA). Both the PE and EA involve extensive analysis of information collected from manufacturers and other sources and may involve field investigations and testing.

## GM Ignition Switch Recall: Who Knew What and When

The problems with the faulty GM ignition switch began more than 12 years ago, when a GM engineer considered and then approved an ignition switch that did not meet the manufacturer's own torque specifications. GM originally installed this ignition switch in redesigned Saturn Ion and new Chevrolet Cobalt models, and later in certain Pontiac G5 and Solstice, Saturn Sky, and Chevrolet HHR models, apparently without recognizing that the inadequate switch would not only turn off the engine if inadvertently jarred out of the "run" position but could also disable the frontal air bags. It was not until February 7, 2014, that GM began recalling these models, announcing its determination that, if the faulty ignition switch is jarred out of the "run" position into the "accessory" or "off" positions before the vehicle's air bag system senses a crash event, the air bags will not deploy.

During the time between GM's approval of the low-torque ignition switch in 2002 and its 2014 recall of 2.6 million vehicles affected by the ignition switch defect, key facts were withheld by, or unrecognized within, GM, making detection of the connection between the faulty ignition switch and non-deployments of air bags difficult for both GM and NHTSA, and leading to a tragic delay in instituting a recall. One key fact involved a change to the ignition switch in 2006. The same GM engineer who approved the inadequate ignition switch authorized a change to increase its torque, but, contrary to company protocol, the part number was not changed. GM installed the reengineered switch in later Cobalt model years, and the decision to not change the part number hindered investigators' attempts to understand why earlier Cobalt models seemed to be having air bag deployment issues that later models did not. GM also failed to adequately address problems that resulted from the faulty part, including stalls caused by the switch easily turning off the vehicle's power.

The number of air bag non-deployments grew, and GM faced litigation for air bag non-deployment claims in instances where the air bags inexplicably did not activate. Although it was repeatedly warned by in-house and outside counsel that a defect preventing air bag deployment seemed to exist, GM failed to detect the safety defect. Years passed before GM made the connection between the switch and the air bag non-deployment and realized the full, tragic, consequences of the faulty ignition switch.

NHTSA's substantive review of the Ion and Cobalt air bag non-deployments began in 2005, following a tragic crash involving a 2005 Cobalt in La Plata, Maryland. Not knowing that the position of the ignition switch was impacting the air bag system, and finding no evidence of component failure, NHTSA sought evidence that the Cobalt/Ion air bags themselves performed so poorly that the air bag system could be unreasonably dangerous. In the early crashes studied by NHTSA, the data did not show that to be the case and the crashes given the most scrutiny were inconclusive, as many were long-duration crashes involving unbelted occupants and impacts with objects that yielded when struck. These crashes involved impacts where the advanced air bag systems in these vehicles would be less likely to deploy.

Three generations of air bag systems existed in the U.S. vehicle fleet when ODI examined air bag non-deployments in the Ion and Cobalt, with the Ion and Cobalt having the most advanced generation. The advanced air bag systems were designed to minimize air bag injury risk. Because air bags can injure occupants who are too close to a deploying bag, these newer systems were less likely to deploy air bags in long-duration crashes where unbelted occupants moved into a danger zone. NHTSA investigators believed at the time that the advanced air bag systems would, as predecessor systems had and many systems still do, operate on reserve power regardless of the vehicle's power state and key position. NHTSA held this understanding of air bag systems–regarding the reserve power and the operation of the system in long-duration crashes with unbelted occupants–when it received information in 2007 about a fatal Cobalt crash in

Wisconsin. This information included a Wisconsin State trooper's opinion that the position of the ignition switch prevented the air bags from deploying during the crash. NHTSA unfortunately did not fully consider this alternate theory as it seemed more likely that the circumstances of the Wisconsin crash and the preceding Maryland crash accounted for the air bag systems not firing the frontal air bags.

Below is an abridged timeline of key events that were examined in the course of assessing NHTSA's actions in response to the information the agency received about Ion and Cobalt air bag non-deployments.

## Fall 2002

A GM engineer approved the use of an ignition switch that fell far short of GM's specification. The switch required less torque than mandated by GM, which meant that it could easily be turned out of the "run" position, such as with the driver's knee hitting a key chain. GM began using this ignition switch in MY 2003 Saturn Ions.[1]

## 2003-2004

After being presented with numerous reports of moving stalls, GM engineers concluded that the moving stalls were not a safety issue, as the driver could still control the vehicle with the engine off. However, they failed to understand that moving the ignition switch out of the "run" position also disabled the air bags unless the system had detected that a crash was in progress.[2]

- August 2004
  Production of the Chevrolet Cobalt began with the same ignition switch that was used in the Saturn Ion.[3]

[1] Anton R. Valukas, Jenner & Block, Report to Board of Directors of General Motors Company Regarding Ignition Switch Recalls, at p 6 (May 29, 2014) available at http://www.nhtsa.gov/.
[2] Ibid.
[3] Ibid, p 57.



- November 19, 2004
  GM employees designated the moving stalls experienced in the Cobalt not as a safety issue, but one of "customer inconvenience." The engineers who determined this, however, again did not understand that the movement of the ignition switch could disable the air bags, and they were not presented with crash or fatality data. This designation further lowered the urgency with which GM addressed the issue, as there was no "acceptable business case" that would support the cost of changing the part.[4]

## 2005

Various committees within GM considered proposed fixes to the ignition switch issue, but each was deemed too costly, especially in light of GM's judgment that the issue was not a safety hazard.[5]

- May 2005
  GM issued the first Service Advisory to dealers regarding engine stall/loss of electrical systems, stating, "The driver may inadvertently turn off the ignition."
- July 26, 2005
  A single-car crash in La Plata, Maryland (Amber Rose) occurred involving a MY 2005 Cobalt. This long-duration off-road crash with an unbelted driver ended in collisions with objects that yielded when struck. The frontal air bag did not deploy and the driver was killed.
- August 26, 2005
  ODI inspected the Rose vehicle, and its SCI division began an investigation.
- December 2005
  GM sent a Technical Service Bulletin (TSB) to its dealers providing information of the potential for drivers to "inadvertently turn off the ignition due to low ignition key cylinder torque/effort." The TSB recommended that customers be told to remove heavy items from their key rings; it also stated that dealers could install a part to change the design of the key ring from a slot to a hole design so the key ring could not move up and down. This proposed solution was only shared with customers who had experienced a stall.[6] However, the TSB did not mention stalls or air bag non-deployment.

[4] Ibid, pp 65-69.
[5] Ibid, p 8.
[6] Ibid, p 8.

## 2006

- February 2006
  SCI issued a final report on the Rose crash, indicating that the air bag system was functioning properly and that the system did not deploy because of the relatively gradual increases in deceleration that occurred in the crash. The Event Data Recorder (EDR) readout attached to the SCI report showed the power was in the "accessory" position.

- April 2006
  The same GM engineer who had approved the original sub-par ignition switch authorized a change to the switch that increased the torque required to turn the key; these new parts went into MY 2008-2010 Cobalts. Contrary to GM's standard protocol, the part number was not changed. This decision hindered investigators' attempts to determine why and how earlier model Cobalts and Ions seemed to be having air bag non-deployments while later models did not.[7]

- October 24, 2006
  A single-car crash in Wisconsin (Amy Rademaker and Natasha Weigel) occurred involving a MY 2005 Cobalt, in which the frontal air bags did not deploy. Like the Rose crash, this crash involved a relatively long off-road excursion and unbelted occupants, and it ended in collisions with objects that yielded when struck.

- October 25, 2006
  GM issued an update to the December 2005 TSB. Like the earlier TSB, this update specifically did not mention stalling, as GM believed this to be a "hot" word that would draw the attention of NHTSA and make customers think there was a safety issue.[8] At the time, NHTSA's position was that stalling represented a safety risk under certain circumstances. These circumstances included the frequency at which stalls occurred, the speed at which the stalls occurred, the ability to restart the vehicle after the stall, and other factors bearing on the magnitude of the risk created by the event.

[7] Ibid, pp 98-100.
[8] Ibid, pp 92-95.



- November 6-7, 2006
  SCI investigated the Wisconsin crash.

- November 16, 2006
  NHTSA received a Vehicle Owner Questionnaire (VOQ) regarding the Wisconsin crash. The VOQ does not mention the ignition switch issue.

- December 28, 2006
  SCI issued a preliminary report on the Wisconsin crash. Slow deceleration during the crash (which, by design, would mean that the air bag would not deploy) was given as the reason for the non-deployment. The text of the SCI report also stated that the ignition key was in the "accessory" position, and that it was "not known" if the key position played a role in the air bag non-deployment.

## 2007

Wisconsin State Trooper Keith Young analyzed the Wisconsin crash, concluding that the movement of the ignition switch from the "run" to the "accessory" position was the cause of the air bag non-deployment. Neither GM nor NHTSA made use of Trooper Young's findings even though GM obtained the report soon after it was completed in February and NHTSA was notified of its conclusions in late April.

From 2007 to 2013, GM faced litigation on several more air bag non-deployment fatalities and was repeatedly warned by outside counsel that a defect existed. However, GM failed to make a defect determination and did not provide the required notification to NHTSA.

- February 14, 2007
  State Trooper Young issued his post-crash report. The Wisconsin State Patrol report stated that it appeared the vehicle ignition switch was "jammed" in the "accessory" position when the car hit the trees, "preventing the air bags from deploying." The report also stated that a search of NHTSA's complaint files revealed five complaints of inadvertent movement of the ignition switch and that GM had issued a TSB in October 2006 documenting the propensity of the switch to move from "run" to "accessory" and shut off the car. The report did not explain why or how State Trooper Young came to believe that the position of the ignition switch would disable the air bags.

- March 6, 2007

  EWD sent a referral to DAD, citing the Maryland crash, 15 VOQs, and 28 field reports with alleged frontal non-deployments. This reflected a total of 43 incidents resulting in 4 fatalities and 27 injuries. DAD reviewed this information and began its own research into the data. At the time, NHTSA had a draft of the SCI report from the Wisconsin crash, which also discussed State Trooper Young's theory.

- March 29, 2007

  ODI met with GM to discuss GM's advanced air bag controller design and system deployment strategies. While the Maryland crash was discussed during this meeting, and NHTSA mentioned observing a number of air bag non-deployments in Cobalts and Ions, no mention was made by GM or NHTSA of the relationship between the ignition switch position and air bag non-deployments. NHTSA made no formal request nor asked GM to follow up on the non-deployment issue.

- April 25, 2007

  The Indiana University (IU) Transportation Research Center, commissioned by NHTSA, provided NHTSA with a draft final SCI report on the Wisconsin crash. IU noted that the ignition switch was "jammed" in the "accessory" position. They also mentioned GM's 2006 TSB, and reported that they found at least six complaints on the NHTSA Web site relating to engine shutoff/loss of power.[9] The IU report did not adopt the Wisconsin State Patrol report's opinion that the key position was the cause of the air bag non-deployment, instead stating it was "not known" if the switch position accounted for the air bags not deploying. IU observed that making such a determination would require an analysis of the air bag system and vehicle wiring beyond the scope of their investigation. The report offered two possible explanations for the air bags not deploying: the relatively slow deceleration crash that began with impacts into yielding trees that uprooted (a situation in which the air bags, by design, would not deploy due to slow deceleration), or the key position.

- August 3, 2007

  NHTSA opened a Defects Assessment Resume (IE 07-080) addressing 2003-2006 Cobalts and Ions. It cited 29 complaints, 11 injuries, and 4 fatalities. It noted that the 4 fatalities and 2 of the injuries were from off-road crashes, which was relevant because such crashes often involve relatively slow decelerations that may, by design, not cause the air bags to deploy.

[9] Ibid, p 132.



- September 5, 2007

  DAD referred the Cobalt/Ion air bag non-deployment issue to VID for review. The DAD referral stated that a pattern of non-deployment existed in Cobalt and Ion that was not seen in peer vehicles. VID began further review.

- October 16, 2007

  VID completed a review of IE 07-080 and found that the rate of Cobalt air bag non-deployments did not stand out, and were actually lower than some of the peer vehicles. VID reviewed a preliminary draft of SCI's Wisconsin report, which mentioned the ignition switch position, but said that the significance, if any, was unknown.

- November 15, 2007

  NHTSA held a Defects Assessment Panel on IE 07-080 and decided not to escalate it to a formal investigation. The panel believed that the air bag non-deployment was because the crashes were long-duration off-road crashes, with a relatively slow deceleration, hitting yielding objects, and the occupants were unbelted, meaning they could have moved out of position during the course of the crash event. In such situations, in accordance with the general reasoning of advanced air bag design, air bags would not/should not deploy for valid safety reasons, specifically that an out-of-position occupant could be injured or killed by the air bag deployment.

## 2008

- January 14, 2008

  NHTSA's VID reviewed 18 EWR air bag non-deployment cases, including cases involving 4 Cobalts, 1 Ion, 4 Trailblazers, 3 Expeditions, 2 Elantras, 2 Tacomas, 1 F-250, and 1 Silverado. Fourteen of these crashes were not relevant to frontal crash protection and 1 was a motorcycle. Of the remaining three crashes: one was a 2004 Ion with a severe pole impact and a long crash pulse; one was the 2005 Cobalt from the Wisconsin crash that also had a long crash pulse; and one was an Elantra struck at an unknown angle which was inconclusive. It was determined that no defect trend was detected.

- March 31, 2008

  IU issued the final SCI report on the Wisconsin crash.

## 2009

- April 1, 2009
  In Pennsylvania, a 2001 Hyundai Sonata driven at more than 60 mph by an intoxicated driver crossed the center line at the crest of a hill, hitting a 2005 Cobalt. The unbelted driver and unbelted passenger in the Cobalt were killed, and their air bags did not deploy. The driver of the Hyundai was killed as well, but his air bag did deploy. When this crash was brought to DAD by the SCI division, DAD encouraged them to investigate.

- April 6, 2009
  SCI began a field investigation of the Pennsylvania crash.

## 2010

- February 1, 2010
  SCI issued a final report on the Pennsylvania crash. The report stated that the cause of the non-deployment could not be determined. However, the EDR readout attached to the report indicated that the vehicle power was in "accessory" mode at the time of the crash.

- February 2010
  VID revisited the Cobalt non-deployments and found that the incident rate had dropped since the 2007 review.

## 2011

- June 16, 2011
  EWD and DAD continued to work together to develop more information. Based on searches of NHTSA's Death and Injury (DI) database, EWD determined that the Cobalt was among the top 30 vehicles for reported air bag issues.

- June 22, 2011
  Further examination of the complaint data showed that MY 2005-2010 Cobalts ranked 13th for the number of complaints where it was alleged that an injury had occurred and an air bag had not deployed.



## 2013

- April 2013
  A plaintiff's expert who compared ignition switches from pre- and post-MY 2008 Cobalts informed GM of his investigation.[10] The expert found that the parts were in fact different. By this point in its investigation, GM was clearly obligated to report the defect to NHTSA and initiate a recall. It did not.

- December 2013
  Having conducted a further investigation that verified the plaintiff expert's findings, the proposed recall was presented to GM's Executive Field Action Decision Committee (EFADC). The EFADC is responsible for issuing recalls, and the decision-makers on the committee included GM's chief engineer. No action was taken, as the chief engineer disputed the data presented, and no fatality information was presented. Instead, the committee requested additional analysis into the root causes of the air bag non-deployments.[11]

## 2014

- February 7, 2014
  GM announced that a safety defect existed in the 2005-2007 MY Chevrolet Cobalt and Pontiac G5 vehicles.

- February 10, 2014
  GM filed a 573[12] indicating that air bag non-deployments were caused by the faulty ignition switch.

- February 26, 2014
  NHTSA opened a Timeliness Query investigation to determine if GM failed to report this defect as required by law.

- March 4, 2014
  NHTSA sent GM a Special Order, seeking documents and answers, under oath, to 107 questions regarding the ignition switch recall. In doing so, the agency sought "to evaluate the timing of GM's defect decision-making and reporting of the safety defect to NHTSA."

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[10] Ibid, p 194.
[11] Ibid, pp 214, 217-18.
[12] Under 49 CFR Part 573, manufacturers must submit a recall defect information report to NHTSA, known as 573, to identify a defect determination. The 573 report outlines the specifics of the safety defect.

- May 16, 2014

  NHTSA announced a settlement of the Timeliness Query, stating that GM had "agreed to pay a record $35 million civil penalty and to take part in unprecedented oversight requirements as a result of findings from NHTSA's timeliness investigation regarding the Chevrolet Cobalt and the automaker's failure to report a safety defect in the vehicle to the federal government in a timely manner."

## Findings

The following paragraphs discuss the findings that resulted from NHTSA's internal review.

### 1. GM withheld critical information about engineering changes that would have allowed NHTSA to more quickly identify the defect.

The linchpin in the investigation was a faulty ignition switch that had been approved by a single GM engineer, who knew the part did not meet GM's torque specifications. The faulty switch allowed the key to easily be jostled out of the "run" position to the "accessory" or "off" position, causing moving stalls and disabling the air bags unless the air bag system sensed that a crash was in progress before the switch position cut power to the vehicle. The designer of the switch and other GM employees studying the switch issue, including the moving stalls, were apparently unaware that the switch factored into air bag deployment. Similarly, NHTSA investigators relied on their own beliefs about air bags remaining armed until their reserve power dissipated after a vehicle was turned off. A lack of understanding about the impact of the key position on air bag function by both GM and NHTSA investigators meant there was not a connection made between the ignition key stalling issue and the air bag non-deployment issue.

Compounding the faulty switch and lack of understanding, the same GM engineer approved a reengineered part that went into later models years, fixing the problem. The reengineered part was not given a new number, contrary to GM's protocol, further hindering investigators' attempts to understand why earlier model Cobalts and Ions seemed to have air bag deployment issues that later models did not. Multiple examinations of the air bag non-deployments, both through the GM engineering and legal investigations, and the NHTSA pre-investigative reviews, failed to uncover this issue. The engineer in question had been asked on multiple occasions if the part had changed, which he denied. Not until an April 29, 2013, deposition for an air bag non-deployment litigation was the fact of the part change revealed.

Subsequently, evidence showed that in-house and outside legal counsel for GM believed a defect preventing air bag deployment existed – ultimately warning that plaintiffs' counsel would very likely convince jurors that the low torque switch was defective.[13] This information was not shared with NHTSA until after the announcement of the recall in 2014. Further investigation of GM's internal practices revealed a culture that was encouraged, even with word choice, to avoid discussing defects and problems openly.[14] NHTSA's May 16, 2014, Consent Order outlined many practices for GM to improve communication with the agency consistent with statutory requirements, as well as good business practices.

### 2. NHTSA did not hold GM accountable for providing inadequate information.

EWD requested multiple Death and Injury Inquiries (DI) from GM regarding different air bag non-deployment incidents. GM's responses often contained very little information and included invocations of legal privilege. Rather than push back and request more information, NHTSA analyzed the incomplete responses, preventing NHTSA from having a complete understanding of all the incidents in question. As discussed below, NHTSA is implementing changes to help ensure the collection of complete data from manufacturers and to enhance oversight of manufacturers and suppliers.

### 3. Neither GM nor NHTSA completely understood the application of advanced air bag technology in GM vehicles.

First-generation air bag systems were intended to protect unbelted occupants in frontal barrier crashes. Providing frontal crash protection to unbelted occupants in these tests required high-powered air bag modules. These high-powered air bags caused more than 290 deaths and a significant number of injuries in minor to moderate crashes. To address this, NHTSA amended its air bag standard in May 2002 to require a new generation of advanced air bags. Among other things, advanced air bags reduce air-bag-related injuries by employing different deployment strategies for belted and unbelted occupants.

In the case of the GM Cobalt/Ion air bags, the air bag supplier, perhaps in coordination

[13] Ibid, pp 112-114, 126, 203-205.
[14] Ibid, p 254.

with GM engineers, designed the advanced air bag system to disarm itself when the key was moved out of the "run" position unless the system had sensed that a crash was in progress. The unintended consequence of this decision was that it elevated the ignition switch to the level of a safety-critical component, which was not communicated or well understood within GM and contrary to the expectations of NHTSA's investigators. Not all manufacturers designed advanced air bag systems with this feature, which was not necessary for compliance with NHTSA's advanced air bag standard. This design also meant that the air bags would not necessarily remain armed until their reserve power dissipated after a vehicle was turned off—a feature of predecessor air bag systems and many current advanced air bag systems.

As discussed below, NHTSA is taking steps to enhance its knowledge of new and emerging technologies. ODI is currently working with another NHTSA division, the Office of Vehicle Safety Research, to conduct industry meetings during which NHTSA can discuss specific technologies and how these new technologies may impact safety systems. Additional staff and resources for training have also been sought in the FY 2016 budget request to help NHTSA increase its knowledge of emerging technologies.

### 4. NHTSA did not consider alternate theories proposed by internal and external sources.

While it is clear that NHTSA was aware of an air bag non-deployment issue, and actively sought a root cause, alternate findings presented by other sources were discounted or not fully investigated. Following the Wisconsin crash, where the EDR readout showed the ignition switch to be in the "accessory position," two reports pointed to this as a possible explanation for the air bag non-deployment in that case. NHTSA did not conduct further investigation of the possible correlation between the ignition switch position and air bag non-deployment, despite the points made by each of these reports. The circumstances of the crashes investigated by NHTSA, including the long duration, yielding objects, and unbelted occupants, seemed to account for the air bag non-deployment, and as noted above, NHTSA believed at the time that the advanced air bag systems would operate on reserve power regardless of the vehicle's power state and key position.



Going forward, to ensure that the agency challenges its assumptions and explores a broad range of alternate theories, NHTSA is implementing a systems safety approach to defects investigations. This approach requires investigators to study and understand how vehicle systems interact and interrelate and directs them to examine possible explanations (even seemingly remote ones) of a safety issue to help determine whether a defect may exist.

### 5. NHTSA did not identify and follow up on trends in its own data sources and investigations.

As outlined above, NHTSA conducted three post-crash investigations where air bags failed to deploy in GM vehicles. Additionally, NHTSA conducted reviews of its own data sources to detect trends. While each of the offices involved in these investigations worked in good faith to find a possible defect, not all information was shared with all parts of the organization. Opportunities to follow up on apparent trends were missed because crucial information was not consistently made available to all key personnel or groups.

Through training and increased interactions among the divisions carrying out NHTSA's defect investigation mission, the agency is enhancing internal communications and information sharing. NHTSA also has already begun to improve its ability to collect, process, and share data. In 2012, NHTSA implemented new business intelligence technologies to enhance ODI's data analysis efforts and to introduce predictive analysis capabilities. Specifically, a corporate information factory (CIF), consisting of multiple software programs that maintain a data warehouse, has been developed to meet the data analytics needs for not only ODI, but for all NHTSA program areas. It helps manage the data related to automotive complaints, and it helps investigators and screeners determine trends and identify defects.

## Process Improvements: Taking Action

The purpose of examining the facts and findings related to the GM ignition switch recall was to identify how NHTSA can improve its ability to detect and investigate defects and protect the American public. After identifying the key findings from this due diligence review, the agency began to make process improvements. These process improvements focus on ODI, with a central objective to enhance the effectiveness of the agency's defect-recall system. A three-person Safety Systems Team of outside experts will spend the next year advising NHTSA on the implementation of these improvements. This team of safety professionals will help ensure that NHTSA accomplishes its goal to improve how the agency identifies, investigates, and remedies safety defects.

While NHTSA has already begun to put some of these improvements in place, some will require additional resources and authority to fully realize. These additional resources are outlined in Appendix A, and in more depth in the report entitled *Workforce Assessment: The Future of NHTSA's Defects Investigations.* The following paragraphs discuss key process improvements.

### 1. *Increase the Accountability of the Automotive Industry*

Under the Safety Act, manufacturers play a vital role in roadway safety, which is why it is particularly troubling that GM withheld information, failed to provide timely responses to NHTSA's requests, and used evasive techniques to distract NHTSA from potential defects. These actions highlight the critical need for NHTSA to exercise its oversight of the industry to the height of its abilities to ensure manufacturers always keep safety as the top priority of any vehicle.

To increase accountability, NHTSA is focusing on both information collection and audits of automotive manufacturers and their parts suppliers (collectively, original equipment manufacturers or OEMs). Also, in addition to the process outlined below for direct contact with OEMs, NHTSA's Office of Chief Counsel is strengthening its relationship with the plaintiff's bar as a way of learning about additional death and injury incidents that may be of interest. Further, the GROW AMERICA Act gives NHTSA authority to further increase industry accountability, such as a nearly tenfold increase in the maximum enforcement fine NHTSA can levy.

**Information Collection**

The following paragraphs detail the improvements ODI is implementing in the collection of information from manufacturers and their parts suppliers. We note that NHTSA has the authority to collect this information, and ODI has initiated actions in these areas, though additional staff and a fully funded CIF (as reflected in the FY 2016 budget request) will be needed to realize the full potential of having additional data.

- Putting OEMs on Notice.
  When ODI is monitoring a high-hazard issue but has insufficient evidence of a possible defect to warrant opening an investigation or has an alternate theory to explore, NHTSA will reach out to the relevant OEM through a pre-investigative notification of interest, promoting OEM accountability by creating a record that NHTSA has informed the OEM of the issue and reiterating the OEM's responsibility to provide relevant and timely information about the issue to the agency, including information critical to the potential safety system interactions of the issue.

- Early Warning Data.
  NHTSA will provide more clarity to manufacturers about the Early Warning Reporting requirements. NHTSA will assist manufacturers as they implement best practices to comply with their obligations to provide complete EWR data. NHTSA is also updating its compendiums, available to manufacturers on Safercar.gov, to provide more detailed information to manufacturers about preparing EWR submissions.

- Rigorous DI Reports and Inquiries.
  NHTSA currently follows up on all reports of crashes that resulted in fatalities, seeking more information about the circumstances and alleged causes of the crashes. In addition, ODI recently implemented revised procedures for DI reports, as manufacturers are now required to provide their opinions about the cause of an incident or crash. Where related litigation is initiated, ODI now requires the manufacturer to provide copies of documents reflecting the final disposition of the lawsuit, including whether the OEM settled the lawsuit. ODI is also submitting a DI to a manufacturer for any claim involving model years and potential defects known to be covered by an initial evaluation (IE), a preliminary evaluation (PE), or an engineering analysis (EA), as well as for all incidents for which a fatality is reported in EWR.

- VOQ Enhancements.
  NHTSA is also working on ways for consumers to provide more complete information to the agency through the VOQ process, including offering more flexibility in how consumers can describe the complaint (for instance, not limiting consumers to component codes) and making it easy for consumers to upload supporting documentation and pictures related to the complaint.

- More Embedded Vehicle Data.
  ODI will specifically request from manufacturers EDR data, vehicle "health check" files, and downloads from any related sub-modules. NHTSA is currently requesting automakers provide detailed information on what additional data is available on vehicles that could be helpful in assessing potential safety defects.

**Oversight and Audit**

When NHTSA finds that an OEM failed to meet its obligation for a timely recall, the agency requires enhanced oversight as it has done in recent consent orders for GM and Hyundai. In addition, NHTSA recommends regular audits of manufacturers' internal processes for finding potential safety defects, and that failures identified during these audits should lead to consequences appropriate to the findings. NHTSA has authority to conduct audit queries, though the agency would need to determine the most effective mechanisms and resources to implement routine audits.

### 2. Increase NHTSA's Knowledge-Base of New and Emerging Technologies

Working with NHTSA's Office of Vehicle Safety Research, ODI is expanding meetings with the automotive industry to further enhance ODI's working knowledge about new and emerging technologies and the interrelationship between vehicle systems. Based on these meetings with manufacturers, ODI is developing a set of inquiries to be used during screening and investigating new safety systems.

### 3. Enhance ODI's Systems Safety Approach to Detection and Analysis

As discussed in the Findings above, ODI is building upon previous efforts to apply an enhanced systems safety approach to the analysis of defects, considering whether one possible defect is a symptom of another system failure. In applying this approach, ODI can question previously held assumptions, employ knowledge of new and emerging technologies, and analyze the effect of diverse possible defect conditions on the operation of the passive and active safety systems of the vehicle, including the supplemental restraint system.

### 4. Enhance Information Management, Analysis and Sharing

With the use of the CIF also mentioned in the Findings above, ODI continues its improvement efforts to effectively utilize and cross-reference EWR data, DI reports and inquiries, SCI investigation reports, and other data from manufacturers and the public that may provide critical details about incidents and vehicles. This CIF will ultimately allow screeners and investigators to identify information about an incident or vehicle in NHTSA's multiple data sets by integrating multiple databases and facilitating data-mining and analysis across these databases. Additional resources will be required (and are sought in the FY 2016 budget request) to continue the development and application of the CIF, to modernize the core data systems used by NHTSA, and to provide the appropriate training and staff to follow up on new potential defects that may be revealed through these efforts.



In addition, to help ensure computer searches produce helpful results, ODI is creating a template to guide staff in annotating DIs (for instance, making sure the relevant safety system is referenced). ODI is training its staff in accessing and interpreting EDR and other embedded vehicle data, and supervisors are ensuring that screeners and investigators know to review all pertinent information, including manufacturer service information (technical service bulletins, service manuals, etc.), when examining a potential defect. Additionally, NHTSA is developing and updating Standard Operating Procedures to assist supervisors in this area.

### 5. Establish Improved Controls for Assessing Potential Defects

ODI is already carefully documenting defect assessment panel presentations and decisions to show the agency's analysis of issues. Issues that do not advance to formal investigations are placed in a monitoring status with an option to revisit. ODI is developing internal controls that *require* the defect assessment panel to revisit an issue or open a formal investigation if certain criteria are met.

### 6. Ensure Effective Communications and Coordination within ODI and between ODI and the Special Crash Investigation Division

ODI is ensuring better coordination and information-sharing within divisions of ODI, as well as other NHTSA defects investigation programs through a variety of new efforts. For example, SCI is now included as an active participant in ODI's decisions about initiating formal investigations. ODI is also developing a process within the CIF to track SCI reports throughout the review process and ensure changes to investigation reports are quickly brought to the attention of other appropriate staff. This process will include an electronic subscription service for SCI reports enabling them to be tagged and allowing analysts to receive an alert when a report they have tagged is modified or updated. ODI will provide ongoing training to screeners and investigators, and foster a collaborative culture within NHTSA to help ensure timely and effective investigations of potential safety-related defects.

Additionally, ODI is launching an internal effort designed to tackle its toughest safety challenges. The Risk Control Innovations Program will use multi-disciplinary teams from across NHTSA to address safety risks or problems that cut across various lines of recall and investigation work and ensure that the agency brings the full weight of its knowledge, experience and capabilities to bear on difficult issues.

## Conclusion

NHTSA initiated this in-depth examination of the GM ignition switch recall to identify the underlying issues that could be addressed to enhance the effectiveness of the agency's defect-recall system. Such scrutiny, while never comfortable, provided the opportunity for the agency to identify vulnerabilities and areas of improvement needed within its defects investigation practices.

The future of NHTSA's defects investigations will involve a safety management system approach. This will capitalize on known and effective safety management system principles and activities and lead to further enhancing the robust safety culture that already exists within the agency. NHTSA is looking at other safety organizations and other transportation modes to improve its safety posture through expanded safety risk management and knowledge sharing, and the agency is bringing in a new Safety Systems Team of outside experts who will provide invaluable guidance as we implement our new approach. The goal is to make timely and effective decisions that lead to actions that protect the American public on our roadways.

NHTSA has already taken strong steps to improve its safety posture and has outlined definite steps toward future progress. The importance of our mission means that we will always look for ways to improve. To that end, we will give careful consideration to the recommendations of the OIG and modify or enhance our process improvements as appropriate.

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