From:	Mike Michels/=TMS/Toyota.	Sent:12/5/2009 2:45 PM.
To: [-]	letters@latimes.com;Nicholas.goldberg@latimes.com;Sue.horton@latimes.com.	
Cc: [-]	Ken.bensinger@latimes.com;ralph.vartebedian@latimes.com;martin.zimmerman@latimes.com.	
Bcc: [-]	Jim Lentz/=TMS/Toyota.	
Subject:	Toyota Response to Editorial: "Toyota's Troubles".	

On behalf of Toyota Motor Sales, USA, we would like to respond to today's editorial opinion regarding reports of sudden acceleration in Toyota vehicles. Toyota appreciates the recognition of recall measures that have been implemented. Heightened awareness of the issue of pedal interference is important for public safety.

Given the intensity of the Times' reporting on this issue, we believe that the Times has a responsibility to publish this letter as soon as possible and in its entirety.

Please attribute the letter to Irv Miller, Group Vice President, Environmental and Public Affairs, Toyota Motor Sales, USA, Inc.

You can reach Mr. Miller at 310 291 2428 or myself at 310 200 4968 if you have any questions.

Thank you for your consideration.

____

Mike Michels
Vice President, Communications
Toyota Motor Sales USA, Inc.
19001 S.Western Ave.
Torrance, CA 90509
Phone: 310 468 7730
Mobile: 310 200 4968
Fax: 310 381 4500
mike_michels@toyota.com

December 5, 2009

To:

Letters to the Editor
Los Angeles Times

Toyota's highest priority is the safety of our customers and public, and we believe we are demonstrating this in the voluntary recall of selected models we are currently undertaking.

We appreciate the LA Times' acknowledgement that Toyota "did the right thing" in instituting a recall in response to incidents of unwanted acceleration, and in committing to add "smart pedal" software technology as an added fail-safe measure. We also respect the Times' in-depth reporting of this issue, though we disagree with some of the theories it has embraced.

The issue of unintended acceleration involving Toyota and Lexus vehicles has been thoroughly and methodically investigated on several occasions over the past few years. These investigations have used a variety of proven and recognized scientific methods. Importantly, none of these studies has ever found that an electronic engine control system malfunction is the cause of unintended acceleration.

In fact, electronic throttle control, which has been adopted in some form by nearly all automakers, has several fail-safe features and enhances vehicle safety by making possible functions such as traction control, stability control, adaptive laser cruise control and snow mode power control on current or future vehicles.

Based on the comprehensive investigation and testing, we are highly confident that we have addressed the root cause of unwanted acceleration -- the entrapment of the accelerator pedal. As the Times acknowledged, Toyota moved quickly, in cooperation with the National Highway Traffic Safety Administration, to issue an initial safety advisory and then to develop a comprehensive package of measures that both reduce the risk of pedal entrapment and better enable drivers to deal with this situation when it occurs.

The safety measures we are undertaking include the incorporation of a brake override system that cuts engine power if the accelerator and brake are depressed at the same time. This will become standard on all Toyota and Lexus vehicles globally by the end of 2010. Dealers will be ready to implement this remedy starting in January. We will begin mailing letters to customers at the end of this month, advising them how to proceed.

Again, the safety of our owners and the public is our utmost concern, and Toyota will continue to thoroughly investigate and take appropriate measures to address any vehicle defect trends that are identified. We also will continue to introduce advanced safety technology into Toyota and Lexus vehicles with the goal of ensuring that they meet the highest industry standards.

Irv Miller
Group Vice President, Environmental and Public Affairs
Toyota Motor Sales, USA, Inc.
Torrance, CA

December 5, 2009

To:

Letters to the Editor
Los Angeles Times

Toyota's highest priority is the safety of our customers and public, and we believe we are demonstrating this in the voluntary recall of selected models we are currently undertaking.

We appreciate the LA Times' acknowledgement that Toyota "did the right thing" in instituting a recall in response to incidents of unwanted acceleration, and in committing to add "smart pedal" software technology as an added fail-safe measure. We also respect the Times' in-depth reporting of this issue, though we disagree with some of the theories it has embraced.

The issue of unintended acceleration involving Toyota and Lexus vehicles has been thoroughly and methodically investigated on several occasions over the past few years. These investigations have used a variety of proven and recognized scientific methods. Importantly, none of these studies has ever found that an electronic engine control system malfunction is the cause of unintended acceleration.

In fact, electronic throttle control, which has been adopted in some form by nearly all automakers, has several fail-safe features and enhances vehicle safety by making possible functions such as traction control, stability control, adaptive laser cruise control and snow mode power control on current or future vehicles.

Based on the comprehensive investigation and testing, we are highly confident that we have addressed the root cause of unwanted acceleration -- the entrapment of the accelerator pedal. As the Times acknowledged, Toyota moved quickly, in cooperation with the National Highway Traffic Safety Administration, to issue an initial safety advisory and then to develop a comprehensive package of measures that both reduce the risk of pedal entrapment and better enable drivers to deal with this situation when it occurs.

The safety measures we are undertaking include the incorporation of a brake override system that cuts engine power if the accelerator and brake are depressed at the same time. This will become standard on all Toyota and Lexus vehicles globally by the end of 2010. Dealers will be ready to implement this remedy starting in January. We will begin mailing letters to customers at the end of this month, advising them how to proceed.

Again, the safety of our owners and the public is our utmost concern, and Toyota will continue to thoroughly investigate and take appropriate measures to address any vehicle defect trends that are identified. We also will continue to introduce advanced safety technology into Toyota and Lexus vehicles with the goal of ensuring that they meet the highest industry standards.

From: <Jeff.Quandt@dot.gov>. Sent:1/21/2010 7:19 AM.
To: [-] <CSantucci@tma.toyota.com>.
Cc: [-] <Scott.Yon@dot.gov>.
Bcc: [-] .
Subject: CATD meeting.

Chris â€" As I mentioned in my phone message to you this morning, here is a rough agenda of topics we would like to discuss, information we would like to see and review and parts we would like to see when we meet at the Central Atlantictraining center.Â Please confirm that Toyotacan meet on Wed and cover the requested agenda items.

Â

Accelerator Pedal assembly return part testing and forensic analysis â€" (see attached)
Pedal assembly data â€" Please bring the following information:
Baseline hysteresis (force-displacement on apply & release) curves for all CTS pedal assemblies and all other hysteresis curves generated from testing done to assess root cause of high resistance â€œstickingâ€□ condition (this should include overlaid curves of baseline part and part with condition (as shown at meeting Tues for Aygo vehicle).
Information describing test procedure for simulating high humidity condition to produce condensation on friction surface (and any changes to part specification based on lessons learned from subject condition)
All material/data that is available regarding the following:

The relationship between age and/or pedal cycles and â€œsmootheningâ€□ of friction surfaces;

The relationship between â€œsmootheningâ€□ and friction for both wet and dry conditions over the full range of pedal stroke;

The relationship between differing amounts of moisture/condensation on the friction over the full range of pedal stroke (for both PPS and PA46);

All Design of Experiment testing to identify contributing factors and assess the influence of each (for both PPS and PA46);

Friction as a function of pedal stroke (for PPS, PA46 and POM) for (1) a new/dry part; (2) a used/dry part; (3) a new/wet part; and (4) a used/wet part; and

The amount of friction necessary to cause a â€œstuckâ€□ pedal over the full range of pedal stroke.

Old & redesigned versions of CTS pedals for Avalon and Tundra
Denso pedal to discuss design for generating friction/feel
Electronic throttle control â€" Review Toyotaâ€™s electronic throttle control system design, including self-diagnostics, associated DTCâ€™s, all FMEA and fault tree analysis related to the ETC system or the accelerator pedal position sensor assembly, throttle body, ECM and associated wiring (this can be limited to conditions related to the potential for unintended acceleration)
Electromagnetic compatibility â€" Review Toyotaâ€™s general EMC standards/testing and discuss how they are applied to the ETC & cruise/speed control systems specifically.
Review Toyota EMC & ETC standards and design strategy
Discuss/compare with other EMC standards (e.g., ISO, SAE, peer mfrs)
Discuss/compare ETC design, testing with peers
Discuss attached article

Â

Please call to discuss and confirm date/logistics.

Â

Thanks,

Jeff

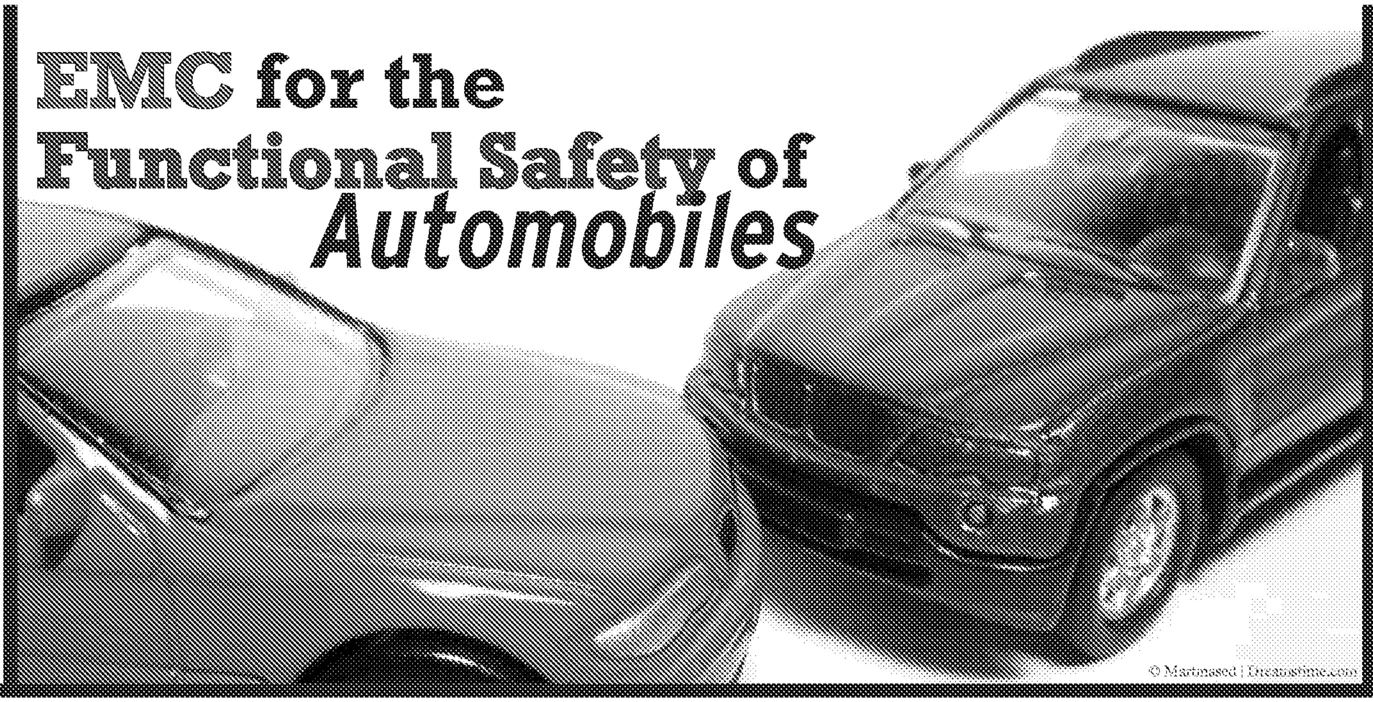
Â

ODI/VRTC/Toyota Removed Components Inspection Protocol

We understand Toyota has one throttle body and two accelerator pedal assemblies which they removed from one vehicle in NJ and one in CA. The following protocol is proposed.

1) Information review (subject parts): Can Toyota provide the vehicle histories, any dealer service/TAS/FTE information related to the alleged component failure (including pictures, videos, notes, and any electronic data taken from the vehicle ECU, etc), a statement on what's been done with each part since its removal from the vehicle (custody, shipment, testing, etc), and the x-rays Toyota did of the components (15 min).
2) Information review (other returned pedal assemblies): Review how Toyota, and/or the pedal supplier, analyzed earlier pedals returned from the field with reports of sticking or slow to return to idle and all related inspection/test reports and forensic data.
3) Component inspection (off vehicle): We'd like to conduct a physical inspection of the each components including manual actuation, a visual assessment, photography and/or videotaping, and discuss any observations or questions with Toyota technical staff (30 min).
4) Component inspection (on vehicle): We'd like to have the two pedal assemblies installed on representative vehicles, make a (static) physical assessment of its operation during actuation, and connect a Tech Stream to assess the electrical operation and collect any pertinent electronic data. If any anomalies are noted we may want to install another (non-suspect) pedal assembly on the vehicle for comparative testing (about an hour or so). *Please advise if equipment can be made available to capture force-displacement data on pedals installed in vehicle (in as received or dry condition and after "component conditioning" discussed in #6.*
5) Test drive: Dependant on the outcome of the above, we'd like to test drive each vehicle with the Tech Stream attached (about 15 or 20 minutes).
6) Component conditioning: Dependent on the outcome of the above, we'd like Toyota to explain and provide a procedure for how they want to 'condition' the pedal assemblies to introduce condensation into the component (the friction system specifically). Toyota can perform the procedure and we will repeat items 3 and 4 above (estimating an hour or so)
7) Component disassembly: Dependent on the outcome of the above, we'd like to disassemble one or both pedal assemblies (see item below) to assess the condition of the internal components and mechanisms.
8) If we are unable to experience any pedal sticking or return-to-close concerns from the above testing we may request to leave one pedal assembly intact so that it can be taken back to VRTC for further assessment. We will discuss and agree this with Toyota at the meeting.
9) Dependent on the outcome of the above, we will discuss and agree future possession and next steps for the above components at the meeting. We may request the throttle body that was removed from the NJ vehicle for further assessment at VRTC.

EMC for the Functional Safety of Automobiles



by EurIng Keith Armstrong, Cherry Clough Consultants

Electronic sub-assemblies (ESAs) are being increasingly used where they could affect vehicle safety risks, including every aspect of drivetrain control, and many aspects of body control, including lighting, displays, indicators and mirrors. Anything that could affect the direct control of a vehicle, or could confuse other road users, is of concern [2]. Indeed, there are many current developments that are safety-related, such as automatic parking, intelligent cruise control, automatic lane following, vision-aids, and vehicle-to-vehicle telemetry (enables vehicles to start braking when traffic ahead slows, even when hidden around bends or in fog) that would not be possible without advanced electronics and its software.

The problem is that all ESAs can suffer from errors, malfunctions and even permanent damage due to electromagnetic interference (EMI). Further, the EM environment is continually worsening due to the increasing use of electronic technologies in all areas of society, especially switch-mode power conversion and wireless communications.

Another problem is that all ESAs rely on semiconductors, either as discrete or integrated circuits (ICs), and the continuing shrinkage in their internal silicon features and reductions in operating voltages are making them more susceptible to EMI. So, for several reasons, the importance of EMI to the safety of vehicular transport is increasing.

Standards in all industry sectors, including the automotive industry, generally deal with EMI-related safety issues very poorly, if they even cover it at all [3] [4] [5]. The few that attempt to address these issues simply require the application of traditional EMC immunity tests that can never be sufficient for ensuring tolerable safety risks over the entire lifecycle, for reasons which we'll described later.

Figure 1 outlines the general situation at the time this article is being written.

Over the last ten years or so, there have been developments in applying risk management techniques to EMC to correctly address EMI-related safety issues. Specifically, there is IEC TS 61000-1-2 [7] (which is effectively the missing EMC Annex of the basic functional safety standard IEC 61508 [8]), and the IET's new guide on "EMC for Functional Safety" [9].

Twelve Reasons Why EMC Testing is Insufficient for Safety

(Also see references [1] [9] [10] [11] and [12].)

1. Anechoic Test Chambers Do Not Simulate Real EM Environments

Traditional radiated field immunity tests specify anechoic test chambers, which are unlike all real-life EM environments experienced by road-going vehicles, so their results can differ markedly from real-life. Vehicle manufacturers overtest to address this and other shortcomings in their test methods, but over-testing cannot compensate for the deficiencies associated with anechoic chambers.

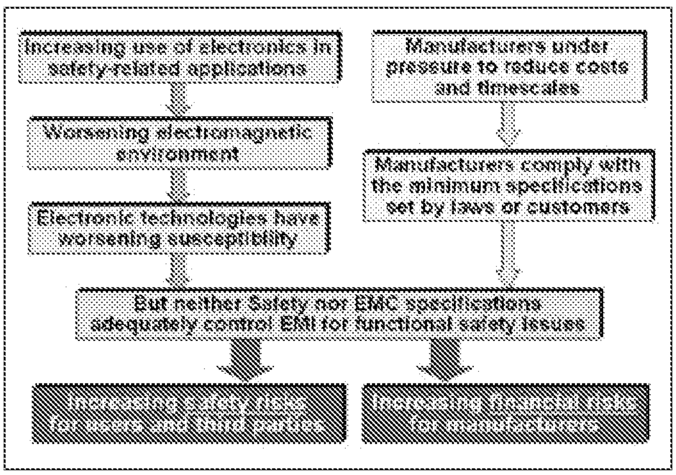


Figure 1: Increasing safety risks due to EMI

Accelerate Speed To Market

Cut time and increase value with one destination for EMC and Environmental Testing.

Time is rarely an ally in product testing. We've streamlined and consolidated our testing resources to help you save time, reduce costs and drive products to market faster. Without sacrificing quality.

You can expose your products to: Heat, Cold, Humidity, Altitude, Vibration, Lightning and the finest engineers around in our state-of-the-art facilities.

Our test labs are more than a collection of equipment. We understand today's stringent regulatory environments and are constantly modifying our process to better meet the changing demands of our business partners.

For example, our testing labs ensure that the unique EMC specifications required by Ford, Toyota, and other automakers are met.

We won't let your project get stuck in traffic.

Call 1-800-TUV-0123 or visit www.TUVamerica.com **today to see how we can help. Please reference code C 1108 .**

Take 60 minutes and attend our FREE On Demand webinars.

- **EMC 101: An Introduction to Electromagnetic Compatibility**
- **Overview of the New EU EMC Directive**

To register, visit: www.TUVamerica.com/webinars

TÜV SÜD America

Choose certainty.
Add value.

C 1108

TÜV®

TOY-RQ-00060026

Some EMC testing experts suggest there are large and unpredictable uncertainties associated with the use of anechoic chambers [13] [14]. Reverberation chambers can provide much more realistic tests [15] [16] and, for this reason (plus their lower costs), they are used by many manufacturers of flight-critical avionics.

2. RF Modulation Types and Frequencies Are Not Realistic

Traditional radio-frequency (RF) immunity tests use 1kHz sinewave modulation for ease of testing, low costs and repeatability, although some vehicle manufacturers employ pulse modulation to simulate digital cell phones and radars, at frequencies above 600MHz or so.

But real-life transmitters use a wide range of analog and digital modulation types and frequencies. References [17] and [18] show that immunity can be significantly degraded (e.g., 20dB or more) when EMI modulation corresponds with frequencies or waveforms used in internal processes, or resonates with circuits, cables, transducers or loads. Therefore, testing with 1kHz is too simple where safety issues are concerned.

Designers of military electronic warfare/countermeasures have known about the importance of modulation to immunity for many decades, but it is only now just starting to be addressed in standards (see [19] and [20]).

3. DC Power Disturbance Tests Are Not Realistic or Thorough

ISO 7637 [21] specifies conducted transient tests to simulate noise on a vehicle's power supply distribution network. The tests use waveforms based on simplifications of the transients that occur in real vehicles, so they can easily and repeatably be generated by low-cost test equipment.

Reference [22] describes tests of the DC power supply on a variety of real vehicles, and shows that the use of even the highest level pulses in [21] can be insufficient for some vehicles. Reference [22] also includes examples of real-life conducted transients in vehicles for which there are, as yet, no corresponding tests.

Varying the timings used by Pulse 2b of Reference [21] can delete the firmware in some ESAs, and varying the test settings can cause some ESAs to switch on or off without command. However, most vehicle and Tier 1 manufacturers do not vary the timings. Instead, they choose settings to reduce testing cost and time, or even to achieve a pass, possibly failing to detect latent unreliabilities that could increase safety risks.

The Ford Motor Company is unique in that its EMC test specification [23] deviates in part from [21] by using chattering relay tests that should produce transient tests with waveforms closer to what is probably experienced in real life.

4. Simultaneous Disturbances Are Not Tested

In real-life operation, ESAs are exposed to simultaneous EM disturbances, for example, two or more RF fields at different frequencies, a radiated field plus a conducted transient or electrostatic discharge, etc. But EMC immunity tests only apply disturbances one at a time.

Simultaneous disturbances that have different frequencies can cause EMI through intermodulation (IM), which (like demodulation) occurs naturally in non-linear devices like semiconductors. Figure 2 shows a simple example of two RF fields at different frequencies, which can cause EMI by:

- Direct interference from each frequency independently;
- Demodulation of the amplitude envelopes of either frequency, or both mixed together;
- Intermodulation, in which new frequencies are created.

Equipment that passes individual immunity tests can be much more susceptible to lower levels of the same disturbances when they are applied two at a time [24].

Vehicles have many independent sources of EM disturbances that can occur at the same time. A simple analysis, based on reasonable assumptions for a 6-cylinder engine at 2000 rpm with spark-ignition transients lasting 50ns, shows that, if there was an average of one unrelated 100ns transient per minute (e.g. due to the actuation of an electric motor or solenoid), there would be a 0.001% likelihood that the 100ns transient would overlap with a 50ns spark-ignition transient.

If this vehicle were driven for 1 hour/day, 5 days/week, 40 weeks/year, the likelihood of it experiencing an overlapping pulse event would be 12% per year. And, if the overlapping pulses caused an ESA to malfunction and caused a 1% chance of death (the official rate of death due to runaway vehicles in the United States over recent decades), the driver would have a risk of death of 0.12% per year. This might not sound much, but it is comparable with the risk of death knowingly accepted

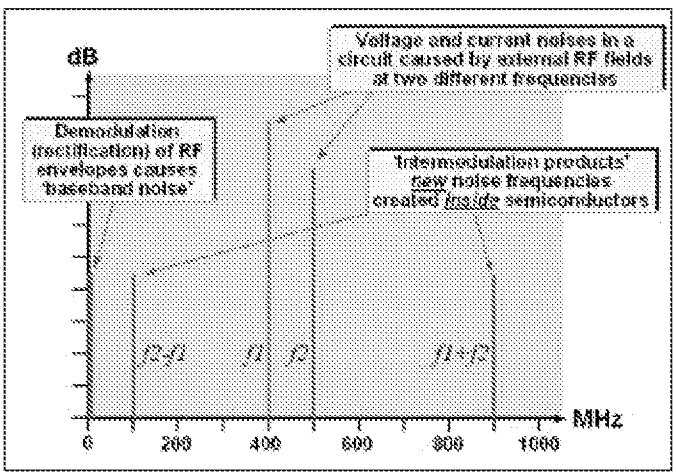


Figure 2: Example of demodulation and intermodulation

by people working in the most hazardous occupations (e.g., oil industry divers). If there were 100,000 such vehicles on the roads for similar periods, we could expect 120 deaths from these overlapping transients every year.

In this example, to be sure of experiencing just one overlapping pulse, a test vehicle would need to be driven 24/7 for 19 weeks. The likelihood of this discovering a significant safety problem is extremely remote, and even then it would almost certainly be diagnosed as something else. Were a customer to complain to his car dealer of a malfunction (that was due to these overlapping transients), the likelihood of the dealer experiencing the problem by test-driving the vehicle for a full eight hours would be very small indeed. Most likely the dealer would assume the driver had simply made a mistake.

5. Only One Port is Tested at a Time

When an ESA is subjected to a radiated RF field, all of its interconnecting cables pick up RF voltages, but with phase differences between them. But traditional EMC conducted immunity tests intended to simulate the effects of radiated fields only test one cable at a time.

Qinetiq PLC has injected RF into all of an ESA's conductors simultaneously, with phase shifts to match what would be expected in real life. They discovered that the immunity could be significantly worse than that experienced when one cable was tested at a time.

6. EMC Tests Ignore the Physical Environment

ESAs that are involved in safety-related activities must maintain certain EM characteristics over their life-cycles, despite the effects of the physical environment, including the following:

- Mechanical (static forces, shock, vibration, etc.)
- Climatic (temperature, humidity, air pressure, etc. – both extremes and cycling effects)
- Chemical (oxidation, galvanic corrosion, conductive dusts, condensation, drips, spray, immersion, icing, etc.)
- Biological (e.g., mould growth, etc.)
- Operational wear and tear over the lifetime (friction, fretting, repetitive cleaning, grease build-up, etc.)

Effects vary from immediate (e.g., non-flat mounting opening a gap and degrading shielding) to long-term (e.g., corrosion of a shield joint or filter ground bond). Reference [25] describes a number of real-life problems of this nature.

Reference [26] shows that a filter can suffer up to 20dB degradation in its attenuation due to a combination of ambient

TOY-RQ-00060028

temperature, supply voltage and load current that are within its specified ratings, when compared with the results of traditional immunity tests.

Highly-accelerated life tests are often used by vehicle manufacturers to verify that functionality will be maintained over the lifecycle, despite the physical environment. But the resulting aged units are rarely, if ever, tested to see if their EM characteristics have degraded, although this is understood to be common practice for Russian military equipment.

7. Quality of EM Design Is Ignored

Manufacturers apply the traditional immunity tests to their products, iterating their designs until they pass. But this approach cannot distinguish between a pass that was achieved by good EM design, or by something that would not be adequately controlled in serial manufacture over the production life of a vehicle.

EMC standards ignore design issues. So, if a product's EM design does not cope with component tolerances, semiconductor die-shrinks, variations in assembly (e.g., cable harnesses, grounding, etc.), replacement of obsolete components, firmware bug fixes, etc., the fact that some samples passed EMC tests means nothing at all for the EM characteristics of the ESAs or vehicles supplied to customers.

8. Assembly Errors are Ignored

Safety engineering generally requires verifying each manufactured product to make sure that assembly errors have not made it unsafe. But traditional EMC standards do not include any requirements for manufacturers to perform routine checks in serial manufacture on the EM characteristics that are necessary for achieving tolerable safety risks.

Automotive EMC test laboratories say that it is not uncommon for ESAs and vehicles that function correctly to fail EMC tests because of a misbuild. When this happens, the manufacturing errors are corrected and they are retested. Although most manufacturers employ rigorous end-of-line testing, including in-circuit test that will discover misbuilds that affect functionality, they do not generally design them to discover misbuilds that could affect EM characteristics.

So, based on type testing, a customer could receive a vehicle that includes one or more assembly errors that could prevent it from having the EM characteristics claimed by its manufacturer.

9. The Maximum Test Level is Not Necessarily the Worst

Electronic devices are non-linear, and circuits, firmware and software can be very complex. So ESAs can fail when tested with EM disturbances at a low level, but fail in a different way, or even pass, when tested at the specified levels. But most EM tests only expose equipment at the highest specified level to save testing time and cost. The likelihood of lower disturbance levels occurring is usually much higher than that of higher levels, so the immunity to low level disturbances could be much more significant for achieving tolerable safety risks.

10. Reasonably Foreseeable Faults are Ignored

Immunity to EMI can be significantly affected by faults, for example:

- Intermittent electrical connections;
- Dry joints, open or short circuits;
- Out-of-tolerance or incorrect components;
- Missing or damaged conductive gaskets;
- Loose/missing fixings in enclosures or cable shielding;
- Failure of a surge protection device.

But traditional automotive EMC testing ignores all faults; only perfect specimens of ESAs and vehicles are tested.

11. Reasonably Foreseeable Use and Misuse are Ignored

Tolerable safety risk levels must be maintained despite reasonably foreseeable use or misuse over the life-cycle. Of course, it is impossible to make anything perfectly safe, but people are known to behave in certain ways, so safety engineering should take this into account.

But traditional EM testing assumes vehicles are driven perfectly at all times, and are not damaged or modified.

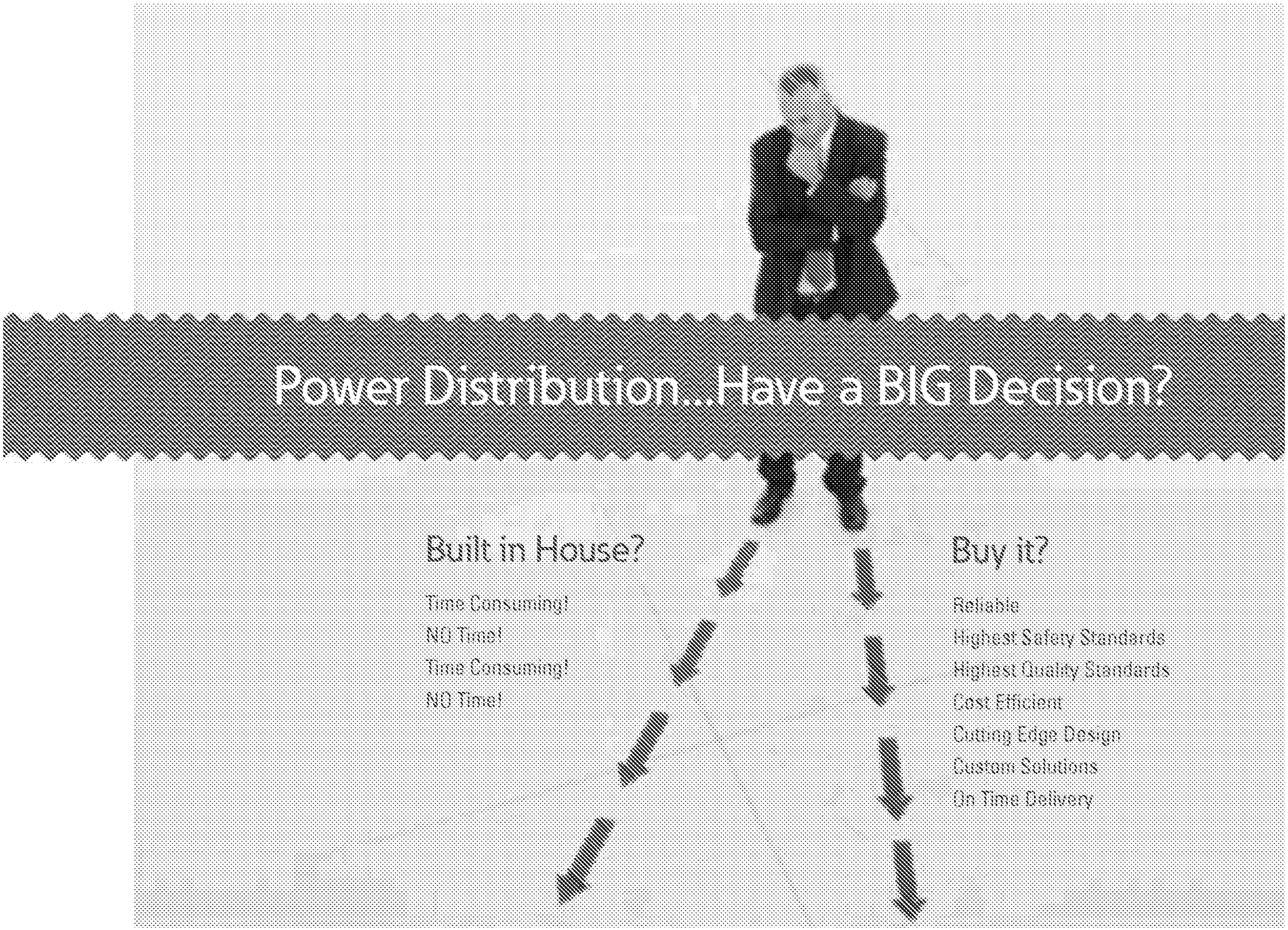
12. Systematic Effects are Ignored

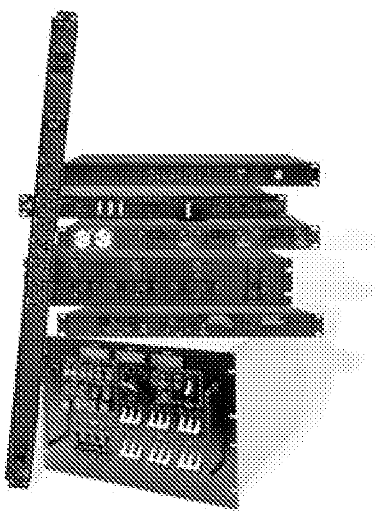
Many system designers incorrectly assume that, if all the ESAs incorporated into a system pass their immunity tests, those systems will also be immune enough.

But performance degradations that are perfectly acceptable when an ESA is EMC tested, or are not even measured during the testing, could have significant implications for the functional safety of systems that use those ESAs. Agreement between the EMC test results on ESAs, and on the systems that incorporate them, is frequently found to be poor. This is often attributed to the principle known as emergence, which states that the characteristics of complex systems cannot necessarily be predicted from the characteristics of its component parts.

What Needs to Be Done

The IET's new guide [9] provides a comprehensive and detailed practical approach to dealing with the issues described above by applying modern risk management principles to EMC. It adopts the principles of [7], but uses an application-neutral language that makes it useful whichever functional safety standard is being applied (e.g., IEC 61508, or ISO 26262), or not. Unlike [7], it includes suggestions for how to take EMC into account when using modern risk assessment methods (e.g., FMEA, fault tree analysis, brainstorming, etc.), and adds checklists that will be useful for management,





Are your power distribution needs currently being built in house?
Do you need a faster and easier solution?

Eaton® manufactures enclosure power distribution units (ePDU™) for both the domestic and international markets. These power distribution units offer an array of features including: circuit breaker protection, EMI and RFI filtering, spike/surge protection, remote power on/off, system-remote reboot, emergency shutdown, redundant power, and sequential power up/down, power control via web browser, telnet, serial & SNMP.

Eaton is committed to understanding customers individual power needs. If a standard product is not available, Eaton can customize a solution for you. Eaton's power distribution units can be configured to your exact specifications. This allows you to have a custom solution at the price of an off the shelf unit.

Make the right decision...
Let one of our experienced application engineers help you with a faster, easier solution!

www.pulizzi.com/cnfm
(877) 785-4994

EATON
Powering Business Worldwide

design, and assessment. Its basic features for an automotive application are described below.

The approach described in [7] and [9] will require a significant learning curve for many manufacturers, functional safety assessors, and EMC test laboratories who want to develop the skills to assess a design's EMC for functional safety.

Manufacturers Need to be More Clever

Using only EMC testing to demonstrate due diligence in achieving tolerable safety risks over a vehicle's lifecycle, requires the twelve issues raised above – and their combinations (for example, an older vehicle with one or more faults, corroded metalwork and conductors, driven incorrectly, suffering multiple physical and EM disturbances simultaneously) – to be addressed by the test program. This would be so lengthy that no organization could possibly afford it. Manufacturers need to be cleverer, if they are to achieve tolerable functional safety risks with reasonable times and costs.

One aspect of this cleverness is to use EM design techniques that ensure safety-related systems will maintain the necessary EM characteristics over their lifetime, taking the reasonably foreseeable EM and physical environments into account [27]. Another is to verify and validate these more robust designs, using a variety of methods (generally including some EMC testing) to achieve the necessary confidence without excessive timescales or costs.

Assessing the Lifetime EM and Physical Environments

An assessment of the reasonably foreseeable real-life possibilities over the vehicle lifetime [28] [29] should include:

- EM disturbances in the near-field (e.g., crosstalk in cable bundles) and far-field (e.g., radio/radar transmitters);
- Intra-system interference (between ESAs in a system);
- Inter-system interference (between different systems in a vehicle, and a vehicle system and the world outside; also considering electronic devices carried by people);
- Modulation types, and their frequencies or waveshapes;
- Simultaneous EM and/or physical disturbances (including continuous, extremes, cycling and transients);
- Possibilities for use and misuse;
- Physical environment(s) (e.g., mechanical, climatic, biological, wear, etc.);
- The effects of aging;
- Future changes to the EM and physical environments;
- Component tolerances, and future changes to components (e.g., obsolescence, die shrinks, etc.)

It is usually only possible to establish the types of EM phenomena (see Figure 3), their modulations and worst-case levels, with any confidence.

Standards from the IEC and military describe a variety of physical environments, but the compatibility levels (or test levels) they specify should not be applied unquestioningly, as they may not have been created for safety purposes.

If a vehicle type is to be sold into an EM and/or physical environment not fully addressed during its original design, an assessment of the new EM and physical environments is required. To maintain tolerable risk levels could require design changes, reverification and revalidation.

Good EM and Physical Design Engineering

There are a great many publications on good EM design techniques that can be applied at different levels of assembly, from ICs to cabling and vehicle structures. Reference [27] discusses a number of well-proven, good EM and physical design techniques for controlling functional safety risks, which is greatly expanded upon in an Annex to [7] and Part 4 of [9].

Hazard Identification and Risk Assessment

A documented hazard identification and risk assessment process is required that assesses how the reasonably foreseeable EM and physical environments over the lifecycle could possibly affect the ESA or vehicle, taking into account faults, misuse, etc. It should show how any excessive risks were reduced to an acceptable degree by design, and be a living document that guides the design process throughout.

Inductive (or consequence) methods start with a low-level error or failure, and try to determine whether it could lead to a hazardous situation. They include failure mode effects analysis (FMEA) and event tree analysis [30].

Deductive (or causal) methods start with hazardous situations, and try to determine what could have caused them, and include fault tree analysis [30].

Brainstorming techniques identify any possibilities. They apply inductive methods to see if the possibilities could have hazardous consequences, and then apply deductive methods to discover what could cause them, and also their likely effects.

It is usual to employ at least one inductive and at least one deductive method to improve the coverage of the risk assessment. Brainstorming is always required to foresee faults, use, misuse, etc., overlooked by standard methods.

All of the above must take into account the EM and physical characteristics of the product and its reasonably foreseeable EM and physical environments over its lifetime. Many vehicle manufacturers and Tier 1 companies employ risk assessment methods, but they tend to do it by rote, which is not recommended by functional safety experts [31] [32].

Any risk assessment method must take into account the fact that some failure modes (e.g., latch-up) can cause some/all of an IC's output pins to change state at the same time, and common-mode EMI causes noise on many/all circuit nodes at the same time. Also, EMI and some types of faults can create noise that can be mistaken for valid signals.

It is generally assumed that two or more independent faults are so unlikely that only single-fault issues need be considered, but this is a misunderstanding. Where the likelihood of certain faults is high enough (e.g., due to inadequate design or assembly) the possibility that two or more such independent faults could occur simultaneously should be taken into account.

When designing a vehicle so that a person can drive it safely, it is also appropriate to use task analysis and human reliability analysis.

EM and Physical Specifications

Specifications should be written for each vehicle safety-related system in order to control their design, manufacture, verification and validation, and the specifications should include EM and physical requirements derived from the above. Specifications for the ESAs to be incorporated in a safety-related system should then be derived from the system's specification, taking into account any EM or physical mitigation measures employed by the system (e.g., shielding, filtering, surge suppression, anti-vibration mountings, forced cooling, etc.)

A Verification/Validation Plan

Achieving sufficient confidence when verifying and validating the design and assembly requires a mixture of techniques [33], none of which is sufficient alone, including:

- Demonstrations
- Checklists
- Inspections
- Reviews and audits
- Independent assessments
- EM tests on ESAs and complete vehicles
- Validated computer simulations

EM tests are most useful when they closely replicate the EM/physical characteristics of the real-world environment(s). It is generally best to base such tests on the standardized test methods, competently modified to better simulate the real life EM/physical environments.

HALT (highly-accelerated life testing) is a powerful tool for assessing the lifecycle suitability of design and assembly methods, and of EM mitigation techniques such as shielding and filtering [34]. Appropriate design of test set-ups can make it possible to detect unacceptably degraded EM performance during HALT testing.

ESAs for use in safety systems always require some final verification/validation tests, as do the completed vehicle safety systems themselves. These tests should be designed to provide the required confidence without high costs.

The EM characteristics of serially-manufactured ESAs and vehicles can be significantly affected by any of the following issues:

- Variations in purchased parts (e.g., IC die-shrinks);
- Alternative or replacement parts;
- Variations in plating, painting and fixing;
- Differences in assembly (e.g., wiring);
- Design changes and improvements;
- Firmware bug-fixes and upgrades, etc.

Therefore, all of the build-state issues relevant for maintaining tolerable functional safety risks should be identified during design, and controlled by quality control (QC).

QC should use a range of techniques; including quick, easy, low-cost EM checks on delivered goods, ESAs and sub-assemblies, plus sample-based testing designed to maintain an acceptable quality level. QC should employ competent personnel, backed up by appropriate testing, to assess every proposal for a design change for its implications for EM characteristics and functional safety risks.

The Results of Verification and Validation

Documents should show how any shortcomings in meeting the specifications were dealt with, and the specifications achieved.

Measures Necessary to Maintain EM Characteristics

Assumptions originally made about real-life EM and physical environments should be verified during the lifecycle of a model of vehicle and, if they are in error, what appropriate actions were taken.

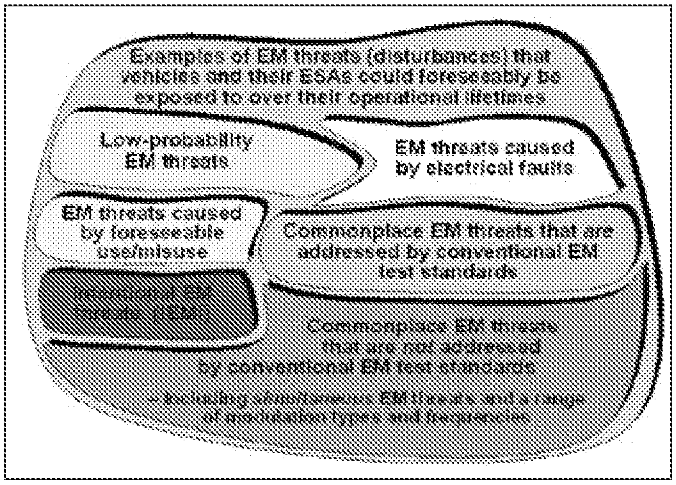


Figure 3: Examples of foreseeable EM disturbances

TOY-RQ-00060032

Appropriate QC activities are required for maintenance, repair, refurbishment, modification and firmware upgrades to ensure that the required EM and physical characteristics are not compromised over the vehicle lifecycle.

Vehicle service schedules might need to include certain checks, tests or component replacements. EMC checks or tests might also need to be devised, and equipment provided for use by relatively unskilled technicians in dealers' service departments for use at scheduled intervals. Computerized diagnostic programs might need to be modified to detect certain EM or physical characteristics.

Repair instructions should include activities that maintain the vehicle's EM/physical characteristics, possibly followed by EM and physical verification to specification. User manuals should recommend activities that help maintain the required EM/physical characteristics over the vehicle's lifecycle, and may need to describe, in layman's terms, how the user can identify EMI as the cause of a problem, and perhaps how to deal with it (in some circumstances).

Documentation – the Safety Case

To help manage functional safety, and for a good defense in case of a legal challenge, a safety case should be created that documents all the activities described above and shows how they achieve tolerable safety risks over the vehicle's lifecycle.

The Amount of Work Required Depends on the Level of Risk

The greater the excess safety risk is above the tolerable level of risk (making increased risk-reduction necessary), the more critical the need that all of the activities described above are more detailed, comprehensive and in-depth, and that they are performed by people who are more knowledgeable and more competent in the necessary techniques.

Conclusions

This article has described a dozen reasons why it is generally not possible to rely solely on EM testing to help achieve tolerable functional safety risks.

We have also shown that rare and untested EMI events that could cause a safety incident only once during a 10-year vehicle life could expose drivers to safety risks comparable with those of the world's most dangerous occupations. These safety risks are most unlikely to be detected by a car dealer, even when a customer complains about the symptoms.

EMI must be treated like any other possible cause of hazards, including malfunctions in firmware [35]. Appropriate techniques in assessing the EM/physical environments, and in design, verification and validation, manufacture, maintenance, repair, modification and upgrade are required to ensure that tolerable safety risks are achieved over the vehicle's anticipated operational lifecycle. ☐

Keith Armstrong *is a principal with Cherry Clough Consultants (www.cherryclough.com) and a frequent contributor to Conformity. He can be reached at keith.armstrong@cherryclough.com.*

The author would like to extend his thanks to functional safety expert John Cryer of the UK's Health and Safety Executive, and automotive industry experts Steve Offer of Robert Bosch Australia, and James Gordon-Colebrook of 3C Test, Silverstone, UK, for their invaluable assistance.

This article is based on a paper presented at the 2008 IEEE EMC Symposium. A longer version of the original IEEE paper was published by the Automotive DesignLine Newsletter in two parts in September 2008. Visit www.automotivedesign-europe.com and search by "EMC."

References

1. D A Townsend *et al*, "Breaking All the Rules: Challenging the Engineering and Regulatory Precepts of Electromagnetic Compatibility," 1995 IEEE International EMC Symposium, Atlanta, pp 194 – 199.

2. 2004/104/EC, the "Automotive EMC Directive," *Official Journal of the European Union*, L 337/13 – L 337/58, November 13, 2004.

3. Keith Armstrong, "New Guidance on EMC-Related Functional Safety," 2001 IEEE International EMC Symposium, Montreal, August 13-17, 2001, ISBN 0-7803-6569-0/01, pp. 774-779.

4. Keith Armstrong, "New Guidance on EMC and Safety for Machinery," 2002 IEEE International. EMC Symposium, Minneapolis, August 19-23, 2002, ISBN: 0-7803-7264-6, pp. 680-685.

5. Keith Armstrong, "Review of Progress with EMC-Related Functional Safety," 2003 IEEE EMC Symposium, Boston, August 18-22, 2003, ISBN 0-7803-7835-0, pp 454-460.

6. Automotive EMC Laboratory Recognition Program (AEMCLRP), www.conformity.com/2631.

7. IEC TS 61000-1-2, basic safety publication, draft second edition, 77/356/DTS February 2008, "Electromagnetic Compatibility (EMC) – Part 1-2: General – Methodology for the achievement of the functional safety of electrical and electronic equipment with regard to electromagnetic phenomena."

8. IEC 61508, basic safety publication, "Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems," (seven parts).

9. IET guide on "EMC for Functional Safety," August 2008, www.conformity.com/2632.

FAST Link | www.conformity.com/2630

10. Keith Armstrong, "Why EMC Immunity Testing is Inadequate for Functional Safety," 2004 IEEE International EMC Symposium, Santa Clara, August 9-13, 2004, ISBN 0-7803-8443-1, pp 145-149. Also: *Conformity*, March 2005, www.conformity.com/2633.

11. Keith Armstrong, "Functional Safety Requires Much More Than EMC Testing," EMC-Europe 2004 (6th International Symposium on EMC), Eindhoven, The Netherlands, September 6-10, 2004, ISBN: 90-6144-990-1, pp 348-353.

12. Keith Armstrong: "EMC in Safety Cases — Why EMC Testing is Never Enough," EMC-UK 2007 Conference, Newbury, UK, Defence & Avionics session, October 17, 2007.

13. L. Jansson and M. Bäckström, "Directivity of Equipment and its Effect on Testing in Mode-Stirred and Anechoic Chamber," IEEE International EMC Symposium, Seattle, WA, August 1999.

14. G.J. Freyer, "Distribution of Responses for Limited Aspect Angle EME Tests of Equipment with Structured Directional Directivity," The 2003 Reverberation Chamber, Anechoic Chamber and OATS Users Meeting, Austin, TX, April 2003.

15. G.J. Freyer and M.O. Hatfield, "An Introduction to Reverberation Chambers for Radiated Emission/Immunity Testing," ITEM 1998.

16. G.J. Freyer, "Considerations for EMC Testing of Systems with Safety and/or Reliability Requirements," EMC Europe 2004, Eindhoven, The Netherlands, September 6-10 2004.

17. S. Wendsche and E. Habiger, "Using reinforcement learning methods for effective EMC immunity testing of computerised equipment," Proc. Int. Symposium EMC (ROMA'96), Rome, Italy, September 1996, pp.221-226.

18. R. Vick and E. Habiger, "The dependence of the immunity of digital equipment on the hardware and software structure," Proc. Int. Symposium EMC, Beijing, May 1997, pp 383-386.

19. RTCA/DO-160E December 9 2004, "Environmental Conditions and Test Procedures for Airborne Equipment, Section 20, Radio Frequency Susceptibility (Radiated and Conducted)." Clauses 20.4 and 20.5 attempt to cover the sensitivity of equipment to modulation type or frequency. The same applies to RTCA/DO-160F (draft 061231).

20. DaimlerChrysler Joint Engineering Standard DC-10614, "EM Performance Requirements — Components," 2004-01. Clause 7 attempts to address modulation type and frequency.

21. ISO 7637-2:2004, "Road vehicles – Electrical disturbances from conduction and coupling – Part 2: Electrical transient conduction along supply lines only"

22. Colebrook *et al*, "Transient Test Requirements for 'e'- Marking," Automotive EMC Conference, November 6, 2003, page 6.

23. Ford Motor Company, "Component and Subsystem Electromagnetic Compatibility, Worldwide Requirements and Test Procedures," ES-XW7T-1A278-AC, October 2003, www.conformity.com/2634.

24. Michel Mardiguian, "Combined Effects of Several, Simultaneous, EMI Couplings," 2000 IEEE International EMC Symposium, Washington D.C., August 21-25, 2000, ISBN 0-7803-5680-2, pp. 181-184.

25. MIL-STD-464, "Electromagnetic Environmental Effects – Requirements for Systems," Department of Defense Interface Standard, March 18, 1997.

26. F Beck and J Sroka, "EMC Performance of Drive Application Under Real Load Condition," Schaffner Application Note 11, March 1999; EMC Zurich, 2001; Power Quality, June 2001.

27. Keith Armstrong, "Design and Mitigation Techniques for EMC for Functional Safety," 2006 IEEE International EMC Symposium, Portland, August 14-18, 2006, ISBN: 1-4244-0294-8.

28. "Assessing an EM Environment," Technical Guidance Note No. 47, EMC Test Labs Association (EMCTLA), www.conformity.com/2635.

29. Keith Armstrong, "Specifying Lifetime Electromagnetic and Physical Environments – to Help Design and Test for EMC for Functional Safety," 2005 IEEE International EMC Symposium, Chicago, August 8-12, 2005, ISBN: 0-7803-9380-5, pp 495-499.

30. IEC 60300-3-1 "Dependability management – Part 3-1: Application guide – Analysis techniques for dependability – Guide on methodology."

31. Erik Hollnagel, "The Reality of Risks," Safety Critical Systems Club Newsletter, Vol. 17, No. 2, January 2008, pp 20-22, www.safety-club.org.uk.

32. Tim Kelly, "Are 'Safety Cases' Working?" Safety Critical Systems Club Newsletter, Vol. 17, No. 2, January 2008, pp 31-33, www.safety-club.org.uk.

33. Keith Armstrong, "Validation, Verification and Immunity Testing Techniques for EMC for Functional Safety," 2007 IEEE International EMC Symposium, July 9-13, 2007, Honolulu, Hawaii, ISBN: 1-4244-1350-8.

34. W.H. Parker, W. Tustin, T. Masone, "The Case for Combining EMC and Environmental Testing," ITEM 2002, pp 54-60.

35. IEC 61508-3: "Functional Safety of Electronic/Electronic/Programmable Electronic Safety-Related Systems– Part 3: Software Requirements."

From: "JEFF GREEN, BLOOMBERG/ NEWSROOM:" <jgreen16@bloomberg.net>. Sent:1/29/2010 3:17 PM.
To: [-] jgreen16@bloomberg.net.
Cc: [-] .
Bcc: [-] .
Subject: Fwd: + Toyota Faces U.S. Congress Probes on Accelerators (Update4).

+ Toyota Faces U.S. Congress Probes on Accelerators (Update4)

Jeff Green
Bloomberg News
Work: +1 (248) 827-2945
Mobile: +1 (248) 310-9015

Sent From Bloomberg Mobile MSG

+--+

Toyota Faces U.S. Congress Probes on Accelerators (Update4)
2010-01-29 22:00:14.643 GMT

(Adds LaHood's comments in starting in eighth paragraph.)

By Angela Greiling Keane

Jan. 29 (Bloomberg) -- Toyota Motor Corp.'s handling of defective gas pedals that led to a record recall of vehicles in the U.S. will be investigated by Congress amid criticism that the automaker may not have acted quickly enough.

Sudden acceleration of Toyota vehicles has been linked to 19 deaths in the past decade, according to House Energy and Commerce Committee Chairman Henry Waxman. His panel plans a hearing Feb. 25, following a Feb. 4 hearing by the House Committee on Oversight and Government Reform.

Lawmakers will examine what the company knew and what it's doing to resolve the problem, Waxman, a California Democrat, said in a statement on his committee's Web site.

"Like many consumers, I am concerned by the seriousness and scope of Toyota's recent recall announcements," he said.

Toyota recalled 2.3 million U.S. cars and light trucks on Jan. 21 for pedal-related problems linked to sudden acceleration. The company separately recalled more than 5 million vehicles to prevent pedals from getting trapped by floor mats. Toyota City, Japan-based Toyota stopped U.S. production and sales on eight models this week.

"The public is unsure as to what exactly the problem is, whether it is safe to drive their cars, or what they should do about it," Representative Edolphus Towns, a New York Democrat and chairman of the oversight and government reform panel, said today in a statement.

The world's largest automaker said it will give customers details next week on a fix to the pedal flaw. Parts supplied by CTS Corp. will be either replaced or new assemblies will be installed, Brian Lyons, a Toyota spokesman, said today. He didn't immediately have specifics on repair timing.

Meeting With Lawmakers

Transportation Secretary Ray LaHood planned to talk today with Towns and the panel's top Republican, Representative Darrell Issa of California, he said in an interview in Bloomberg's Washington office. He said he will appear before Congress to explain how his agency handled the pedal issue.

While Toyota officials met with committee lawmakers and staff this week, "we continue to have questions about what was done to investigate and resolve this safety issue both by Toyota" and the National Highway Traffic Safety Administration, said U.S. Representative Bart Stupak, Democrat of Michigan and chairman of the subcommittee on oversight and investigations.

"Incidents of sticking accelerators have been ongoing with Toyota vehicles for up to a decade, and have led to a disproportionately high number of deaths," Stupak said.

"Failure to take every possible step to prevent future deaths or injuries is simply unacceptable."

"Toyota appreciates the opportunity to inform the committee" about the problem and the company's efforts to address it, Ed Lewis, a Toyota spokesman in Washington, said in a statement today.

Dealer Losses

U.S. dealers who sell Toyota's namesake brand may lose as much as $2.47 billion in combined monthly revenue because of the sales halt, said John McEleney, the chairman of the National Automobile Dealers Association and owner of McEleney Toyota in Clinton, Iowa.

The automaker said today it would also recall eight models in Europe, including some Corolla and Avensis cars. The move may cover as many as 1.8 million vehicles. Toyota's effort to fix the pedals doesn't extend to Japan, where it uses different parts makers.

Waxman and Stupak said they asked Toyota North America President Yoshimi Inaba and David Strickland, NHTSA administrator, for more information on the matter.

Analysis and Review

The regulator and Toyota both moved too slowly to pinpoint the problem and advise consumers about dangerous pedal-related defects, Joan Claybrook, a former NHTSA administrator, said in an interview yesterday.

"They weren't doing much with enforcement," Claybrook, a former head of the Washington-based advocacy group Public Citizen, said of the safety agency. "They're supposed to review, analyze and go back to the companies and say, 'What's going on here?'"

LaHood defended the automaker and the safety agency.

"Toyota has followed the law," he told Bloomberg reporters. "Our people did a good job."

The accelerator pedals drew attention after a California Highway Patrol officer and three family members were killed in an August accident. A floor mat on a Lexus sedan he was driving may have jammed the pedal and caused the car to speed out of control, according to Toyota.

Public Clash

NHTSA and Toyota clashed publicly over the recalls last year.

In November, the safety agency said Toyota was "inaccurate and misleading" in comments the company made on the problem. Toyota had issued a statement two days earlier saying U.S. safety investigators found no defect existed in vehicles "in which the driver's floor mat is compatible with the vehicle and properly secured."

The agency said Toyota's remedy didn't "correct the underlying defect," which it said was related to the accelerator pedal and floor pan design. LaHood urged Toyota owners to remove floor mats.

LaHood said yesterday that he's "absolutely" satisfied with the performance of NHTSA, which until this month lacked an administrator under President Barack Obama.

Before Strickland was confirmed as administrator this month, NHTSA's acting administrator Ron Medford traveled to Japan to meet with Toyota, LaHood said.

"The problem is that NHTSA always has the underdog role" in dealing with automakers, said Sean Kane, president of Safety Research & Strategies Inc., a safety advocacy group in Rehoboth, Massachusetts.

Long History

NHTSA's office of defects investigation has a staff of only 20, has no expertise in electronics and has a "long history of missing unintended-acceleration complaints that can't be easily identified," Kane said in an interview yesterday. "They relied a lot on Toyota to tell them what the issues are and that's not uncommon. The sophistication of Toyota is at a much greater level than that of the agency."

NHTSA has been in "constant contact" with Toyota throughout the course of the recalls, said Karen Aldana, an agency spokeswoman.

Toyota's American depositary receipts, each representing two ordinary shares, fell 67 cents to $77 at 4:15 p.m. in New York Stock Exchange composite trading. The receipts have dropped for six consecutive trading days.

For Related News and Information:
Toyota recalls: 7203 JT <Equity> TCNI RECALL <GO>
Auto-industry regulation: TNI AUT RULES <GO>
U.S. auto industry sales: SAARTOTL <Index> GP <GO>

--With assistance from John Hughes and Roger Runningen in Washington, Alan Ohnsman in Los Angeles, Cornelius Rahn in Frankfurt, Mike Ramsey and Doron Levin in Southfield, Michigan and Makiko Kitamura in Tokyo. Editors: Joe Richter, Romaine Bostick

To contact the reporters on this story:
Angela Greiling Keane in Washington at +1-202-654-1287 or agreilingkea@bloomberg.net;

To contact the editor responsible for this story:
Larry Liebert at +1-202-624-1936 or lliebert@bloomberg.net

From: Christopher Tinto/=WDC/Toyota_NY.	Sent:2/9/2010 5:54 PM.
To: [-] chris santucci; [redacted]	
Cc: [-] .	
Bcc: [-] .	
Subject: Fw: WSJ: Secretive Culture Led Toyota Astray.	

See below

Best Regards,
Chris

____
Sent from Wireless handheld

From: [redacted]
Sent: 02/09/2010 08:37 PM EST
To: '[redacted]
Subject: WSJ: Secretive Culture Led Toyota Astray

FEBRUARY 10, 2010

WSJ: Secretive Culture Led Toyota Astray

By KATE LINEBAUGH, DIONNE SEARCEY and NORIHIKO SHIROUZU

Wall Street Journal

For six years, evidence mounted that cars made by Toyota Motor Corp. could accelerate unexpectedly. The problem was a suspected factor in crashes causing more than a dozen deaths.

Toyota blamed the problem on floor mats pinning the gas pedal—until Jan. 19. That day, in a closed-door meeting in Washington, D.C., two top executives from the auto maker gave regulators surprising news: Toyota knew of a mechanical defect in its gas pedals. And Toyota had known for more than a year.

The two top officials from the National Highway Traffic Safety Administration "were steamed," according to a person who discussed the meeting with both sides. As the meeting closed, NHTSA chief David Strickland hinted at handing down the agency's toughest punishments, which can include forcing auto makers to stop selling cars.

The yearlong delay and other newly uncovered details from the crisis enveloping Toyota reveal a growing rift between the Japanese auto maker and NHTSA, one of its most important regulators. Regulators came to doubt Toyota's commitment to addressing safety defects, according to interviews with federal officials and industry executives, and accounts of interactions between Toyota and NHTSA the past year.

The heart of Toyota's problem with U.S. regulators: Its secretive corporate culture in Japan clashed with U.S. requirements that auto makers disclose safety threats, people familiar with the matter say. The relationship soured even though Toyota had hired two former NHTSA officials to manage its ties with the agency.

Toyota acknowledges the rift with regulators. "Believe me, we have changed our mindset," said Shinichi Sasaki, Toyota's quality chief, referring to a heated December confrontation in Tokyo with NHTSA officials over floor mats. "We don't believe this is going to be a problem in the future. We are completely on the same page with NHTSA."

Toyota's woes have roots in 2001's redesigned Camry sedan, which featured a new type of gas pedal. Instead of physically connecting to the engine with a mechanical cable, the new pedal used electronic sensors to send signals to a computer controlling the engine. The same technology migrated to cars including Toyota's luxury Lexus ES sedan. The main advantage is fuel efficiency.

But by early 2004, NHTSA was getting complaints that the Camry and ES sometimes sped up without the driver hitting the gas. It launched its first acceleration probe, focusing on 37 complaints, 30 of which involved accidents, according to a NHTSA document filled out by Scott Yon, an agency investigator, dated March 3, 2004.

Mr. Yon and another NHTSA official, Jeffrey Quandt, discussed the case several times over the next 20 days with Toyota, according to an affidavit by a Toyota executive filed in a Michigan lawsuit related to one of the fatal crashes. In that accident, a 2005 Camry allegedly raced out of control for a quarter-mile, and sped up to 80 miles per hour from 25, before crashing and killing its driver.

By the end of the month, Mr. Yon updated his NHTSA case file with a memo. It said NHTSA had decided to limit the probe to incidents involving brief bursts of acceleration, and would exclude so-called "long duration" incidents in which cars allegedly continued to accelerate down the road even after the driver hit the brakes. That decision would come back to haunt regulators.

The reason: Investigators decided it would be easier to isolate any possible defect by zeroing in on shorter incidents rather than the longer ones, an NHTSA official said. The shorter incidents looked more like "pure cases of engine surging due to a possible defect," the official said. Longer incidents were excluded because they showed more signs of driver error such as mistaking the accelerator for the brake.

Messrs. Quandt and Yon didn't respond to requests for comment.

Of the 37 incidents, 27 were categorized as long-duration and not investigated. On July 22, 2004, the probe was closed because NHTSA had found no pattern of safety problems.

Complaints kept rolling in. In 2005 and 2006, NHTSA got hundreds of reports of unintended acceleration involving Toyotas, according to Safety Research & Strategies, a consumer-safety research firm. On two occasions, Toyota filed responses arguing that no defect or trends could be found in the complaints.

In March 2007, the agency opened a new probe, focusing on whether the gas pedal in the Lexus ES350 sedan could get caught beneath heavy rubber floor mats sold as accessories. It looked at five crashes, including four multivehicle accidents. In some cases, cars reached speeds of 90 miles per hour.

NHTSA sent surveys to 1,986 owners of ES350s. Six-hundred responded, and 59 said they had experienced unintended acceleration. Thirty-five of those attributed the engine surge to a floor mat pressing down on the gas pedal. The rest either didn't specify or cited other possible explanations.

NHTSA officials worked on the probe with their main contact at Toyota, Christopher Santucci. The NHTSA team knew Mr. Santucci: He had worked there from 2001 to 2003. Mr. Santucci's supervisor at Toyota, Chris Tinto, had worked at NHTSA in the past, too. Messrs. Santucci and Tinto didn't respond to requests for comment.

At one point, Mr. Santucci brought a Lexus ES350 to the parking lot of FedEx Field outside Washington, D.C., for some testing. Messrs. Yon and Quandt raced the car across the pavement, hitting 60 miles per hour before jamming on the brakes to measure the force needed to stop a speeding car.

It's common for NHTSA to work cooperatively with all auto makers in this way. NHTSA can do its own testing, but it generally relies on manufacturers to supply technical data. Its Office of Defects Investigation has only 57 employees to deal with some 35,000 complaints a year.

Car makers "are almost self-regulated," said an auto-industry chief executive who has worked closely with NHTSA. Without help from makers, "there's really is no way for NHTSA to look into all these issues."

To spur cooperation, the agency has the power to force auto makers to conduct a recall. It can fine companies for providing misleading information or not providing safety-related information in a timely fashion.

More photos and interactive graphics By August 2007, NHTSA wanted Toyota to issue a Lexus and Camry recall to remove the bulky, all-weather floor mats Toyota blamed for the acceleration problems. "Toyota assured us that this would solve the problem," said Nicole Nason, then NHTSA's administrator.

In their probe, NHTSA investigators asked Toyota, "Are you sure it's not the gas pedal?" Ms. Nason said. "They assured us it's just the floor mat."

Toyota says that, at that time, it had no indication of problems with the pedal design.

Toyota ended up recalling Camrys and ES350s from the 2007 and 2008 model years, telling owners to remove the all-weather floor mats. The action involved 55,000 cars.

After the recall, reports continued trickling in that the recall may not have resolved the issue. One major case was 2008's spectacular fatal crash in Michigan. On April 19 of that year, [redacted] 77 years old, was driving a 2005 Camry on Copeman Boulevard, a residential street in Flint. She was traveling at about 25 miles per hour when the car accelerated to 80, according a lawsuit filed against Toyota in Michigan. The car raced about a quarter mile before going airborne and colliding with a tree eight feet off the ground, killing [redacted] according to the suit. The lawsuit, in Genesee County circuit court in Michigan, remains under way.

Floor mats couldn't have been the cause. [redacted] had removed hers days before the accident, said one of the attorneys handling the case against Toyota. The accident was similar to the "long duration" type that had been excluded from NHTSA's first probe in 2004.

A year later, NHTSA was asked to open a new probe by a Minnesota man who said his Lexus ES350 took off on a highway and raced for two miles before he regained control. Toyota filed a rebuttal, saying it believed a floor mat was the cause.

Separately, since December 2008 Toyota's European unit had been looking into a problem causing cars in Ireland and England to surge or fail to slow. After months of testing, Toyota found the culprit: a plastic part in the pedal mechanism also widely used in the U.S.

Toyota redesigned the pedals for new cars coming off the assembly line. But it didn't issue a recall in Europe or notify U.S. regulators. Nor did Toyota alert its U.S. unit to the situation in Europe, according to a person familiar with the matter.

Last month, Mr. Sasaki of Toyota said it didn't do a European recall or alert U.S. regulators then because it thought the problem wasn't a safety issue.

Toyota is still very much run by its Japan headquarters, despite being active in the U.S. since 1957 and building vehicles here for two decades. Top leadership doesn't include American executives. The Toyota officials who run the recall process are in Japan, 12 times zones away.

For reasons like these, Toyota often reacted relatively slowly to safety issues raised by NHTSA, according to three people familiar with Toyota's inner workings.

"What has really happened is a breakdown in communications within Toyota" between its D.C. office and Japan headquarters, said one of these people. "The Washington office didn't have the information it needed to provide to the government."

In August 2009, another fatal accident in the U.S. put the problem in the national spotlight. [redacted] a California Highway Patrol officer, was driving a Lexus ES350 near San Diego when it accelerated to more than 100 miles per hour.

As the car careened out of control, one of its occupants called 911 to report their emergency. "Our accelerator is stuck," the male caller said in the recording. "There's no brakes.... We're approaching the intersection. We're approaching intersection. Hold on. Pray. Pray."

The 911 call cut out when the car crashed. Everyone in the vehicle died, including [redacted] his wife, daughter and brother-in-law. The tape of the 911 call aired on television and made its way to the Internet, drawing attention to the acceleration issue.

The Lexus, a loaner from a dealer that [redacted] was driving while his car was being serviced, did have the all-weather mats. And a previous driver of the loaner had reported the mat had entrapped the pedal.

At NHTSA, patience was wearing thin. Its deputy, Ronald Medford, summoned Toyota officials to a Sept. 25 meeting in Washington, and told them they needed to faster to more fully resolve the mat problem. Replacing mats wasn't enough, he said. Toyota also had to alter its gas pedals to make sure they couldn't get caught on mats.

On Oct. 5, Toyota recalled 3.8 million vehicles to fix the floor-mat issue, its largest ever recall.

But tension between NHTSA and Toyota continued to rise. On Nov. 3, Toyota put out a statement saying NHTSA had concluded that "no defect exists" in the recalled vehicles. A day later, in an unusually public rebuke, NHTSA released its own statement saying Toyota had put out "inaccurate and misleading information" and that the agency was still investigating "this very dangerous problem."

Around the same time, the two were at odds again over a completely different issue. Toyota recalled Tundra pickup trucks for a corrosion problem that could lead to the spare tire falling off the back of the truck. But the recall hadn't come as quickly as NHTSA wanted, according to people familiar with the matter. Toyota had also been reluctant to include corrosion issues affecting the fuel tank and the rear brakes, one person said.

On Jan. 8, Toyota amended its original recall to include the fuel-tank corrosion issue, at "the urging of the Office of Defects Investigation," according to a letter to NHTSA. Toyota stressed that it didn't consider the issue "a safety related defect."

Toyota acknowledges the regulators felt frustration, according to a person familiar with the matter, but says the situation "presented some challenges that needed to be figured out."

Amid all these disagreements, NHTSA's Mr. Medford and several other agency officials got on a plane to Japan. On Dec. 15 they stood before about 100 Toyota executives and engineers and explained Toyota's obligation to comply with the U.S.'s defect-recall process, an Transportation Department official said.

Later, Mr. Medford met with a smaller group of top Toyota executives. According to the official, Mr. Medford told them bluntly: Toyota was taking too long to respond to safety issues. He also reminded them that Toyota is obligated under U.S. law to find and report defects promptly.

Mr. Sasaki, Toyota's customer-quality chief, was among the attendees. During the meeting, he said, there was a "debate" in which NHTSA representatives objected to Toyota's view that "it would have been desirable if consumers [in the U.S.] installed floor mats properly." The regulators' response, Mr. Sasaki said, was that Toyota couldn't expect that from every consumer. "NHTSA people expressed disbelief over Toyota's view, and we received some harsh words from them," Mr. Sasaki said.

Eleven days later, the day after Christmas, four people died in Texas when the Toyota Avalon they were in accelerated, crashed through a fence and landed in a pond. Floor mats weren't the problem—police found them in the trunk.

On Jan. 4, NHTSA's new chief, Mr. Strickland, was sworn in. His first crisis walked in the door Jan. 19, when two Toyota executives told him that Toyota's Japan headquarters had known there was a design flaw in their gas pedals for more than a year.

A few days later, Toyota had the details of its 2.3-millon-vehicle recall worked out. But there was a hitch: Toyota didn't have enough parts in hand to make repairs immediately.

At times, NHTSA gives car makers extra time to get replacement parts ready when recall notices go out. This time, regulators said no dice. They told Toyota if it didn't have a fix, it would have to stop selling cars. On Jan. 26, that's what Toyota did.

From: Christopher Tinto/=WDC/Toyota_NY. Sent:2/9/2010 5:54 PM.
To: [-] chris santucci;[redacted]
Cc: [-] .
Bcc: [-] .
Subject: Fw: WSJ: Secretive Culture Led Toyota Astray.

See below

Best Regards,
Chris

____
Sent from Wireless handheld

From: [redacted]
Sent: 02/09/2010 08:37 PM EST
To: [redacted]
Subject: WSJ: Secretive Culture Led Toyota Astray

FEBRUARY 10, 2010

WSJ: Secretive Culture Led Toyota Astray

By KATE LINEBAUGH, DIONNE SEARCEY and NORIHIKO SHIROUZU

Wall Street Journal

For six years, evidence mounted that cars made by Toyota Motor Corp. could accelerate unexpectedly. The problem was a suspected factor in crashes causing more than a dozen deaths.

Toyota blamed the problem on floor mats pinning the gas pedal—until Jan. 19. That day, in a closed-door meeting in Washington, D.C., two top executives from the auto maker gave regulators surprising news: Toyota knew of a mechanical defect in its gas pedals. And Toyota had known for more than a year.

The two top officials from the National Highway Traffic Safety Administration "were steamed," according to a person who discussed the meeting with both sides. As the meeting closed, NHTSA chief David Strickland hinted at handing down the agency's toughest punishments, which can include forcing auto makers to stop selling cars.

The yearlong delay and other newly uncovered details from the crisis enveloping Toyota reveal a growing rift between the Japanese auto maker and NHTSA, one of its most important regulators. Regulators came to doubt Toyota's commitment to addressing safety defects, according to interviews with federal officials and industry executives, and accounts of interactions between Toyota and NHTSA the past year.

The heart of Toyota's problem with U.S. regulators: Its secretive corporate culture in Japan clashed with U.S. requirements that auto makers disclose safety threats, people familiar with the matter say. The relationship soured even though Toyota had hired two former NHTSA officials to manage its ties with the agency.

Toyota acknowledges the rift with regulators. "Believe me, we have changed our mindset," said Shinichi Sasaki, Toyota's quality chief, referring to a heated December confrontation in Tokyo with NHTSA officials over floor mats. "We don't believe this is going to be a problem in the future. We are completely on the same page with NHTSA."

Toyota's woes have roots in 2001's redesigned Camry sedan, which featured a new type of gas pedal. Instead of physically connecting to the engine with a mechanical cable, the new pedal used electronic sensors to send signals to a computer controlling the engine. The same technology migrated to cars including Toyota's luxury Lexus ES sedan. The main advantage is fuel efficiency.

But by early 2004, NHTSA was getting complaints that the Camry and ES sometimes sped up without the driver hitting the gas. It launched its first acceleration probe, focusing on 37 complaints, 30 of which involved accidents, according to a NHTSA document filled out by Scott Yon, an agency investigator, dated March 3, 2004.

Mr. Yon and another NHTSA official, Jeffrey Quandt, discussed the case several times over the next 20 days with Toyota, according to an affidavit by a Toyota executive filed in a Michigan lawsuit related to one of the fatal crashes. In that accident, a 2005 Camry allegedly raced out of control for a quarter-mile, and sped up to 80 miles per hour from 25, before crashing and killing its driver.

By the end of the month, Mr. Yon updated his NHTSA case file with a memo. It said NHTSA had decided to limit the probe to incidents involving brief bursts of acceleration, and would exclude so-called "long duration" incidents in which cars allegedly continued to accelerate down the road even after the driver hit the brakes. That decision would come back to haunt regulators.

The reason: Investigators decided it would be easier to isolate any possible defect by zeroing in on shorter incidents rather than the longer ones, an NHTSA official said. The shorter incidents looked more like "pure cases of engine surging due to a possible defect," the official said. Longer incidents were excluded because they showed more signs of driver error such as mistaking the accelerator for the brake.

Messrs. Quandt and Yon didn't respond to requests for comment.

Of the 37 incidents, 27 were categorized as long-duration and not investigated. On July 22, 2004, the probe was closed because NHTSA had found no pattern of safety problems.

Complaints kept rolling in. In 2005 and 2006, NHTSA got hundreds of reports of unintended acceleration involving Toyotas, according to Safety Research & Strategies, a consumer-safety research firm. On two occasions, Toyota filed responses arguing that no defect or trends could be found in the complaints.

In March 2007, the agency opened a new probe, focusing on whether the gas pedal in the Lexus ES350 sedan could get caught beneath heavy rubber floor mats sold as accessories. It looked at five crashes, including four multivehicle accidents. In some cases, cars reached speeds of 90 miles per hour.

NHTSA sent surveys to 1,986 owners of ES350s. Six-hundred responded, and 59 said they had experienced unintended acceleration. Thirty-five of those attributed the engine surge to a floor mat pressing down on the gas pedal. The rest either didn't specify or cited other possible explanations.

NHTSA officials worked on the probe with their main contact at Toyota, Christopher Santucci. The NHTSA team knew Mr. Santucci: He had worked there from 2001 to 2003. Mr. Santucci's supervisor at Toyota, Chris Tinto, had worked at NHTSA in the past, too. Messrs. Santucci and Tinto didn't respond to requests for comment.

At one point, Mr. Santucci brought a Lexus ES350 to the parking lot of FedEx Field outside Washington, D.C., for some testing. Messrs. Yon and Quandt raced the car across the pavement, hitting 60 miles per hour before jamming on the brakes to measure the force needed to stop a speeding car.

It's common for NHTSA to work cooperatively with all auto makers in this way. NHTSA can do its own testing, but it generally relies on manufacturers to supply technical data. Its Office of Defects Investigation has only 57 employees to deal with some 35,000 complaints a year.

Car makers "are almost self-regulated," said an auto-industry chief executive who has worked closely with NHTSA. Without help from makers, "there's really is no way for NHTSA to look into all these issues."

To spur cooperation, the agency has the power to force auto makers to conduct a recall. It can fine companies for providing misleading information or not providing safety-related information in a timely fashion.

More photos and interactive graphics By August 2007, NHTSA wanted Toyota to issue a Lexus and Camry recall to remove the bulky, all-weather floor mats Toyota blamed for the acceleration problems. "Toyota assured us that this would solve the problem," said Nicole Nason, then NHTSA's administrator.

In their probe, NHTSA investigators asked Toyota, "Are you sure it's not the gas pedal?" Ms. Nason said. "They assured us it's just the floor mat."

Toyota says that, at that time, it had no indication of problems with the pedal design.

Toyota ended up recalling Camrys and ES350s from the 2007 and 2008 model years, telling owners to remove the all-weather floor mats. The action involved 55,000 cars.

After the recall, reports continued trickling in that the recall may not have resolved the issue. One major case was 2008's spectacular fatal crash in Michigan. On April 19 of that year, [redacted] 77 years old, was driving a 2005 Camry on Copeman Boulevard, a residential street in Flint. She was traveling at about 25 miles per hour when the car accelerated to 80, according a lawsuit filed against Toyota in Michigan. The car raced about a quarter mile before going airborne and colliding with a tree eight feet off the ground, killing [redacted] according to the suit. The lawsuit, in Genesee County circuit court in Michigan, remains under way.

Floor mats couldn't have been the cause. [redacted] had removed hers days before the accident, said one of the attorneys handling the case against Toyota. The accident was similar to the "long duration" type that had been excluded from NHTSA's first probe in 2004.

A year later, NHTSA was asked to open a new probe by a Minnesota man who said his Lexus ES350 took off on a highway and raced for two miles before he regained control. Toyota filed a rebuttal, saying it believed a floor mat was the cause.

Separately, since December 2008 Toyota's European unit had been looking into a problem causing cars in Ireland and England to surge or fail to slow. After months of testing, Toyota found the culprit: a plastic part in the pedal mechanism also widely used in the U.S.

Toyota redesigned the pedals for new cars coming off the assembly line. But it didn't issue a recall in Europe or notify U.S. regulators. Nor did Toyota alert its U.S. unit to the situation in Europe, according to a person familiar with the matter.

Last month, Mr. Sasaki of Toyota said it didn't do a European recall or alert U.S. regulators then because it thought the problem wasn't a safety issue.

Toyota is still very much run by its Japan headquarters, despite being active in the U.S. since 1957 and building vehicles here for two decades. Top leadership doesn't include American executives. The Toyota officials who run the recall process are in Japan, 12 times zones away.

For reasons like these, Toyota often reacted relatively slowly to safety issues raised by NHTSA, according to three people familiar with Toyota's inner workings.

"What has really happened is a breakdown in communications within Toyota" between its D.C. office and Japan headquarters, said one of these people. "The Washington office didn't have the information it needed to provide to the government."

In August 2009, another fatal accident in the U.S. put the problem in the national spotlight. [redacted] a California Highway Patrol officer, was driving a Lexus ES350 near San Diego when it accelerated to more than 100 miles per hour.

As the car careened out of control, one of its occupants called 911 to report their emergency. "Our accelerator is stuck," the male caller said in the recording. "There's no brakes.... We're approaching the intersection. We're approaching intersection. Hold on. Pray. Pray."

The 911 call cut out when the car crashed. Everyone in the vehicle died, including [redacted] his wife, daughter and brother-in-law. The tape of the 911 call aired on television and made its way to the Internet, drawing attention to the acceleration issue.

The Lexus, a loaner from a dealer that [redacted] was driving while his car was being serviced, did have the all-weather mats. And a previous driver of the loaner had reported the mat had entrapped the pedal.

At NHTSA, patience was wearing thin. Its deputy, Ronald Medford, summoned Toyota officials to a Sept. 25 meeting in Washington, and told them they needed to faster to more fully resolve the mat problem. Replacing mats wasn't enough, he said. Toyota also had to alter its gas pedals to make sure they couldn't get caught on mats.

On Oct. 5, Toyota recalled 3.8 million vehicles to fix the floor-mat issue, its largest ever recall.

But tension between NHTSA and Toyota continued to rise. On Nov. 3, Toyota put out a statement saying NHTSA had concluded that "no defect exists" in the recalled vehicles. A day later, in an unusually public rebuke, NHTSA released its own statement saying Toyota had put out "inaccurate and misleading information" and that the agency was still investigating "this very dangerous problem."

Around the same time, the two were at odds again over a completely different issue. Toyota recalled Tundra pickup trucks for a corrosion problem that could lead to the spare tire falling off the back of the truck. But the recall hadn't come as quickly as NHTSA wanted, according to people familiar with the matter. Toyota had also been reluctant to include corrosion issues affecting the fuel tank and the rear brakes, one person said.

On Jan. 8, Toyota amended its original recall to include the fuel-tank corrosion issue, at "the urging of the Office of Defects Investigation," according to a letter to NHTSA. Toyota stressed that it didn't consider the issue "a safety related defect."

Toyota acknowledges the regulators felt frustration, according to a person familiar with the matter, but says the situation "presented some challenges that needed to be figured out."

Amid all these disagreements, NHTSA's Mr. Medford and several other agency officials got on a plane to Japan. On Dec. 15 they stood before about 100 Toyota executives and engineers and explained Toyota's obligation to comply with the U.S.'s defect-recall process, an Transportation Department official said.

Later, Mr. Medford met with a smaller group of top Toyota executives. According to the official, Mr. Medford told them bluntly: Toyota was taking too long to respond to safety issues. He also reminded them that Toyota is obligated under U.S. law to find and report defects promptly.

Mr. Sasaki, Toyota's customer-quality chief, was among the attendees. During the meeting, he said, there was a "debate" in which NHTSA representatives objected to Toyota's view that "it would have been desirable if consumers [in the U.S.] installed floor mats properly." The regulators' response, Mr. Sasaki said, was that Toyota couldn't expect that from every consumer. "NHTSA people expressed disbelief over Toyota's view, and we received some harsh words from them," Mr. Sasaki said.

Eleven days later, the day after Christmas, four people died in Texas when the Toyota Avalon they were in accelerated, crashed through a fence and landed in a pond. Floor mats weren't the problem—police found them in the trunk.

On Jan. 4, NHTSA's new chief, Mr. Strickland, was sworn in. His first crisis walked in the door Jan. 19, when two Toyota executives told him that Toyota's Japan headquarters had known there was a design flaw in their gas pedals for more than a year.

A few days later, Toyota had the details of its 2.3-millon-vehicle recall worked out. But there was a hitch: Toyota didn't have enough parts in hand to make repairs immediately.

At times, NHTSA gives car makers extra time to get replacement parts ready when recall notices go out. This time, regulators said no dice. They told Toyota if it didn't have a fix, it would have to stop selling cars. On Jan. 26, that's what Toyota did.