2010 Toyota Electronic Throttle Control Webinar

February 23, 2010

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OPERATOR: Ladies and gentlemen, please remain on the line. Your scheduled conference will begin shortly. We do appreciate your patience. Please remain on the line. Thank you.
Welcome to today's Toyota conference call. Mr. Hanson, the floor is yours.

JOHN HANSON: Good day, and thank you all for joining us for this web based seminar on two very important issues. I am John Hanson, National Environmental Safety and Quality Communications Manager. The issue of unintended acceleration has been a part of the auto industry for decades, probably since the invention of the brake and accelerator pedals themselves.

As you know, some have suggested that unwanted acceleration incidents may be caused by something more than mechanical problems, pedal interference, or human factors. The speculation is that electronic throttle control systems are mysteriously accelerating vehicles out of the driver's control. Yet no actual evidence of this has been produced by various advocates and experts, nor have Toyota or others found any sign that electronic throttle control systems have been involved in cases of unwanted acceleration.

And as I'm sure you are aware, Toyota has engaged a world-class engineering and scientific consulting firm to independently test all aspects of electronic throttle control systems. This work is ongoing and expected to take weeks, if not months. It will be peer reviewed and audited and available to the public for verification.

Because automotive electronic systems and testing have emerged as high profile issues, we want to provide important background about how these systems work, how their failsafe logic provides numerous layers of safeguards, and the strenuous testing they undergo. Today's presentations are somewhat technical, but it takes more than a quick sound bite to understand how they work and to appreciate why we are so confident that all of the potential causes of unwanted acceleration electronic controls are extremely unlikely.

I encourage you to consider science, rather than suggestion, in the debate on these matters. Today we will hear from Paul Williamsen of the University of Toyota, our education and training organization, who will review electronic throttle control system operation and failsafe provisions.

Next, Kristen Tabar, General Manager of Electronics Engineering at Toyota Technical Center in Michigan, will show you testing methods for electromagnetic and static discharge. Our discussion today is limited to these technical issues, and our presenters do not have information on other aspects of the unintended acceleration debate.

Out of respect for your time and interest in the designated topic, we will not take off-topic questions, nor will we comment on the upcoming Congressional hearings during today's online session. We appreciate that you are taking the time today, and we hope this information will provide valuable background and context on this important issue.

And now I would like to introduce Paul Williamsen.

PAUL WILLIAMSEN: Thank you, John. In order to help you understand how electronic throttle control works in Toyota, Lexus, and Scion vehicles, I've actually prepared some fairly detailed animations that'll help to – help you to understand the system. And the content I'm going to share with you I believe is largely generic to the industry. There isn't much that I've found here that's Toyota, Lexus, or Scion specific.

We're going to start with an introductory video, and in order for you to see that video of me introducing the system, you'll need to go to Toyota's press room web site in another browser window. So while I'm talking, go ahead and open a second browser window. Go to the URL https://pressroom.toyota.com/webinar-videos, and I'll give you just a second to do that.

And once you're there, we have cued up on that page, webinar-videos, the five media that I'm going to share with you today. Before you hit the play button, I'll just let you know that these also will be available on that same page for high definition download, so if you wish to use these in any of your editing processes, you're welcome to do that. So if you've had time to go to that URL, go ahead and press the play button, and you'll get my introduction on this topic.

Again, if you need the URL for the videos, that's at https://pressroom.toyota.com/webinar-videos, and we're currently on video number one, "Electronic Throttle Control Overview and Electronic Fuel Injection Simulator."

Thank you for your understanding, working with us on this technology. I'm hoping that most of you were able to see the total of that four-minute introductory video. And again, for all of you, you can download that later and review it again at your leisure.

At this point, we'll move on to dive into the system with a little more depth. So a subsystem of our engine management systems is electronic throttle control, and what I'm going to have you do is again go back to that same web site and cue up the second video, which is actually an animation that goes into some detail on the development and the current state of the art in computer-controlled electronic throttle control.

So again, in your browser window at https://pressroom.toyota.com/webinar-videos, at this point, click to view the second video, which is actually an animation called "ETCS." That stands for electronic throttle control system. Thank you.

So hopefully, many of you have now been able to see the second video that details and animates how the electronic throttle control system works. I think we're going to re-send the URL for any of you who logged in late and didn't get that message that in addition to the webinar in the one browser window, you'll need a second browser window in order to be able to see the videos that we're cueing up.

And again, we appreciate your patience. This is a high tech system, and we're trying to use all the technology we have available to us to help you understand it.

So the next aspect that we have prepared for you to learn about the system is how our throttle control system in specific diagnoses itself and what fail safes we've built into the – into the vehicle. The diagnosis of throttle control and the fail safes are both much more critical than those features for other engine control technologies.

We have our highest order of redundancy, of error checking, and of fail safes for the throttle control of virtually any subsystem of the engine management system. So in order to learn more about that, I'll ask you to again toggle over to your second browser window, and go to our pressroom.toyota.com site to the webinar-videos page, and we'll now watch video number three, "ETCS Animation Diagnosis."

And I'll give you a couple of minutes so that we've got some time for all of you to go view that video. So go ahead and hit play, and let that be – start downloading. Thanks.

So I hope most of you have had a chance to see the animated video on diagnosis of our throttle control system, so just to kind of bring everybody into synch, we have one final topic that I'll cover with you, and then we'll take your questions on the electronic throttle control system. Following that, we'll move into the second portion of our presentation, which is on how we test for compatibility with electromagnetic radiation.

The next topic that I've prepared for you is – addresses a broad range of concerns about what it something goes wrong with my vehicle. And here I actually detail for you the four failsafe systems that we have designed in specifically for electronic throttle control. We have different fail safes that we employ, depending on the nature of the failure.

So there are some vehicle hardware failures where we'll allow the vehicle to still be driven and controlled; others where the vehicle will only idle, basically allowing you to coast to the side of the road; and some where we'll determine that for safety reasons, we need to turn the engine off completely.

So at this point, if you would go to the pressroom site, you'll be playing the fourth animation – the fourth video, called "ETCS Animation – What If."

So I hope that that video worked for you, and cumulatively those videos and animations collectively were designed to share with you the confidence we have in our electronic throttle control subsystem and overall our engine management system on all of our vehicles.

For those of you that had problems seeing or hearing the videos online, we apologize. I think the best suggestion is that to perhaps afterwards, after we're done with this presentation, you might download them to your computer and then play them locally from your hard drive, and based on that, if you have additional questions that occur to you later, of course you can reach out to us through our press contacts with Q&A subsequently.

So at this point then, I think we'll take questions that you have on the electronic throttle control system, and if you have questions you want to share with us, then we'll be able to see those, and we'll be able to respond to you. And so we'll invite your questions on that topic at this time.

HANSON: So we will ask the operator then to flip over into the Q&A mode, and there will be a slight delay.

WILLIAMSEN: And again, you can send questions either by text or by voice at your preference.

OPERATOR: Certainly. The floor is now open for questions over the phone. If anybody does have a question, please press star one on your telephone keypad at this time. If you're using a speakerphone, we ask that when posing your question you pick up your handset to provide favorable sound quality. Again, ladies and gentlemen, if you do have a question or comment, please press star one on your telephone keypad at this time. Please hold while we poll for questions.

Again, if you'd like to ask a question, please press star one. Please hold while we poll for some questions.

Our first question is from Drew Winter from Ward's Auto Group. Please go ahead.

DREW WINTER: Hi, Paul. My question – sorry – my question is does this mean with the data that is stored in the – in the ECM or the default codes that now you can do a forensic look at any vehicles that have been – claimed sudden acceleration, that you can access that data to see if the – there was some sort of fault condition going on in the vehicles that are alleged to have sudden acceleration?

WILLIAMSEN: Yes, Drew, thanks for your question. So we've had diagnostic capabilities in our engine control modules for well over a decade now, and so any time there is an electrical fault in a circuit or in an actuator or in the computer, we've got the ability to record those diagnostic trouble codes – DTCs, as we call them – and any technician, not just a Toyota technician – any technician can read out the diagnostic trouble codes on our vehicles, and our publicly available repair information would let them determine what the specific meaning is of each code.

Unfortunately, in the vast majority of unintended acceleration cases, we don't find meaningful trouble codes, either because there were no trouble codes in the vehicle prior to the incident, or sometimes after the incident the computer may be in a physical condition where we can't retrieve information out of it.

And so that's been one of the challenges that we have in dealing with this issue is that there simply is no past trail of evidence in the diagnostic system that would point to any particular electrical or electronic failure prior to these unintended acceleration incidents.

WINTER: Now, is this different from the black box that is in most vehicles?

WILLIAMSEN: Well, so that's been an interesting phrase that – the use of the phrase, "black box." You know, we use that term fairly generically. In our cars we have a number of computers, each assigned to specific primary systems, so the engine management computer, the ECM, is one dedicated computer, dedicated to all under hood and power train functions. That also includes then transmission shifting on a contemporary computer-controlled transmission.

There is a separate computer for the air bag system, and that computer is the one that I think people often mean when they use the phrase, "black box." The air bag computer has its own diagnostic process, and it actually – on our contemporary vehicles for the last decade – actually records not just trouble codes, but in fact raw input data from all of the sensors to the air bag system, and it keeps a running tally of those. But that's unrelated to this topic today.

WINTER: OK, thank you.

WILLIAMSEN: Yes.

OPERATOR: Our next question is from Michael Warshaw from the Boston Globe. Please go ahead.

MICHAEL WARSHAW: Hi. Mr. Williamsen said that they'd done a number of studies on whether or not the electronic control systems were at the root of incidents of unintended acceleration. I was – wanted a little more detail on those studies when they were performed – whether they were – he was referring to studies that Toyota did or whether NHTSA was involved and, you know, if they -if they weren't caused by the electronic system, what did they find were the causes?

WILLIAMSEN: So we've had a recent study commissioned by an outside third party called Exponent. We don't yet have the results of that study. This is something that's been done recently, and we expect to get those results soon, and of course we do our own internal studies as well, but in every case to date – again, minus the fact that we don't yet have the results of Exponent's study …

WARSHAW: Yes.

WILLIAMSEN: … but we've not found any evidence that problems with the computer system are causing unintended acceleration. NHTSA, of course, has done their own studies, but those are – those are NHTSA's, not ours.

WARSHAW: So you're talking about your own studies in the last few years, or 15 years …

HANSON: This is John Hanson. We have conducted numerous studies over I'd say the last six, seven years, when this issue has come up, and through all those testings that we've done, we have not been able to find any electronic problem with our system that would have led to unintended acceleration.

I can tell you that we are still actively investigating reports, and we will continue to do so. It is to our advantage to find any problems so that we can fix them. So the answer to this is yes, we've done it many times, and we will continue to respond to customer complaints of instances of unintended acceleration.

WARSHAW: Did you – did you ever find a cause for any of these incidents?

HANSON: Well, I guess one way to answer this is that there have been many times when we simply have not been able to find a cause for the report that was lodged by the owner. That doesn't mean there wasn't a problem. It means that we've been unable to find a problem. We've not been able to repeat the situation. We've not been able to find any (inaudible) that has led to unwanted acceleration.

WARSHAW: Thank you.

WILLIAMSEN: You're welcome.

OPERATOR: Our next question is from Ari Schwartz from NHK. Please go ahead.

ARI SCHWARTZ: Yes, hi. One thing that I'm wondering – I'm sorry I came in a little late to all this, and I might have missed the first or second clip – is what happens if a system like cruise control malfunctions and sends a faulty signal to the throttle, as opposed to someone sending it – the – pardon me – sending the signal through the pedal?

WILLIAMSEN: So one of the pluses, Ari, is that with electronic throttle control, the cruise control is no longer a separate system. It's now integrated into the engine management system, and it benefits from the same of level of failsafe and diagnostics that we devote to electronic throttle control. You know, historically of course, cruise control systems could be added on to a – an old-fashioned carburetor.

But these days, it's fully integrated. And so again, all of the fail safes are there, we can diagnose the cruise control switch to make sure that it's working correctly. In addition, there's just some very basic parameters we do with cruise control where, for instance, the maximum allowable increase speed is set to a fairly low level, so it wouldn't ever be as if you'd, you know, floored the gas pedal.

And, you know, I think the final thing I'll say about the cruise control is that it also – the cruise control system – has many things that will cause it to turn off. So for instance, any time you touch the brake pedal, just pressure on the brake pedal – enough to make the brake lights illuminate – will cause the cruise system to disable.

So it actually is a much better integrated system than how cruise control would have been on cars without electronic throttle control.

SCHWARTZ: Thank you.

OPERATOR: Our next question is from Alan Ohnsman from Bloomberg News. Please go ahead.

ALAN OHNSMAN: Yes. Hi, Paul. I just wanted to get clarification on a couple of things. The hall effect sensor on the CTS pedal assemblies – do you know who the manufacturer of that was? Was that the same manufacturer that also supplied the component fused on – the same sensor used on the Denso pedals? And then right – at this point, is ETCS used on pretty much every model you sell in the U.S., under all the various badges (ph)?

WILLIAMSEN: So, Alan, I'm not sure – we're not aware of – if there are sub suppliers of components to the pedals. Denso and CTS both make different design pedals that meet our spec. They both use hall effect sensors, and I couldn't comment on who their sub suppliers are. And – what I can say is we have no evidence that there are any problems with the hall effect sensors on any pedals. You know, we have had the sticky pedal issue on a few parts. But that's unrelated to the hall effect sensor.

To your second question about how long or what our percentage is – we currently have 100 percent use of electronic throttle control system on all of our products that we sell in North America, and I think we achieved that a few years ago. We began electronic throttle control in '98 and rolled it out very broadly after 2001, and we've been 100 percent for a couple of years.

OHNSMAN: OK. Thank you.

HANSON: This is John Hanson. We're going to move on now to Kristen Tabar, General Manager of Electronics Engineering and Toyota Technical Center in Michigan, who will show you testing methods for electromagnetic and static discharge, and then we'll open it up again for Q&A after Kristen has finished.

KRISTEN TABAR: Thank you, John. I'm going to speak to you today regarding, as John mentioned, regarding the electromagnetic testing that we do at Toyota for the variety of systems that we put in the vehicle. Moving to the summary slide shown here, you can see that today I'm going to walk you through the electromagnetic compatibility testing that we do and that referencing the standards or international standards with which we set our test specification and criteria.

I'll try to give you some image of how those standards compare and the criteria that we use, compared to the real world testing that we do, and walk you through how we actually do the tests.

This slide shows a little bit how we approach the vehicle electromagnetic compatibility, or EMC. We really see it in two sections. To the left side of the slide, we show the emissions. This is the radiated energy coming from every electronic device. We check each of the systems in the vehicle and how those devices interact with the other devices in the system as well as the environment around them.

The second half is immunity, shown on the right hand side of the slide. This is how we design and test our parts to protect from incoming interference from the surrounding devices or surrounding things in the environment.

So as you can see, we really take a holistic approach, looking at standards for the regional locations that we're in, as well as international standards. We combine that with our field survey results to merge and blend in the real world environment that the vehicle will see, compared to those standards, and then we look at both the design and the testing of the part, the system, and the vehicle, to protect against such interactions.

This next slide will show you a little bit of how we approach the design and testing processes. The first half of this slide is showing you that we start at the part level, and we use our best practices for hardware and software design. We actually create the designs, and we create prototypes of those parts and systems. Then we put those parts and systems through tests.

If there's any issues with the part or system testing, we go back to the design stage of course and re – make any countermeasures necessary. If the part or tests are – the part or system testing is OK and can pass our requirements, we then move to the second half of the testing, which is the vehicle level testing that'll be shown on the right half of the page.

This testing includes again a general design, including where we package the parts and the vehicle, how we route the wires to the vehicle, and how we protect the parts in the system from these emission or immunity type situations. We then go ahead and prototype that and do the vehicle level testing, very similar to the part or system level testing, but at the vehicle level.

If there's any issues with that, we'll go back to the design either on the vehicle side or on the part side, make any countermeasures necessary, and then again go through the same testing process that's shown here, until we're sure that there's no issues with any of the parts or systems in the vehicle.

This next slide will show you some of the things that we are considering when we design our immunity testing. This is typical items that we would expect to see in a vehicle environment that may affect the electronic performance. We look at things such as consumer electronic devices, like cell phones. We look at the vehicles in the surrounding area – there are several commercial suite vehicles that may have onboard transceivers, two-way radios, and things like that that may cause interference.

There's certainly – at the bottom of the page, you can see various antenna that are broadcasting, cellular TV, radio antennas, as well as your typical noise sources, such as power lines and electrostatic discharge. That's just from the humans themselves operating the equipment in the vehicle.

From our test standards, we develop our performance target. These are both done at a design and a test strategy. As you can see from the slide, the component level and the vehicle level from a design perspective need to meet or exceed the international standard.

Especially for the vehicles, as I mentioned earlier, we also consider our regional field surveys to try and assess the worst case conditions that the vehicles will see on an everyday basis, to ensure the quality of the systems. From a test method perspective, we use the same philosophy, then we follow all the international standards, as well as any of the regional regulations.

In some cases, where those standards or regulations don't exist, we even go beyond that and create our own test standards, based on our know-how or experience, and then we – again, using those field surveys – create the criteria for those tests.

This shows – the next slide will show just a little bit about how we approach the testing procedures. The tests are really broke down into, as I mentioned, two types – emission testing, or the outbound energy, and immunity testing, or the inbound energy. We look at it from both a part and system level, as well as a vehicle level.

This chart is meant to show you just a flavoring of some of the tests that we would do for all those different scenarios. Today we're going to focus on some of the immunity tests and give you a little bit more detail about those, including some graphics or picture representations, to give you, you know, a good foundation and understanding of what some of the testing we do entails.

This next slide is one such test. This is one of our immunity tests. We call this a 10-cell (ph) or stripline test. The main purpose of this is to test for low frequency interference. This would be something like an FM broadcast antenna.

It simulates that type of frequency band, and as you can see from the chart, there are international standards that we are following from SAE or ISO. And the development targets that we use, as I mentioned – we try to consider any regulatory requirements that are in the regions where we are operating the vehicles or testing the vehicles.

In this case, there are no U.S. regulations surrounding the low frequency interference, so we've referenced the EU regulation, and as you can see, there's quite a significant margin against that regulation. In EU, this test requires compliance up to a 75 volt per meter field strength.

Our target is 200 volts per meter, so well (ph) three times higher than that. These – this goes to the – to the understanding of Toyota that we need to have this significant margin to ensure that even under the worst case, not just the regulation, but under the worst case scenario, our vehicles operate properly. The two pictures shown at the bottom of the chart are our test fixtures that represent the 10-cell (ph) and the stripline testing.

The next slide will walk you through the antenna radiation immunity test. This is very similar to the test that I just explained, except it's the high end of the frequency band, simulating more – something more like a cell phone interference.

Again, the international standards are shown, and we do follow those. And in this case, again, the EU regulation is used as reference, lacking a U.S. regulation for this, and our development target is a full six times higher than what the regulation would require. This picture shows the test – the test setup. You can see the square device in the background. That's the antenna that would be bombarding the parts sitting on that long table, and then we're able to take measurements and confirm the operation of the device during the testing and make sure that even under those very high levels of field strength that the part operates correctly.

This next slide shows our test for immunity, again at a part level. This is an antenna nearby immunity test. This would simulate antenna or energy sources that are very close to the part while it's in operation – something like a two-way radio or again maybe a cell phone interference.

In this case, this example, there is no international standard, and Toyota created our own standard for this. We test from the 20-megahertz to the 2-gigahertz range, and our target is again the 200 volts per meter or more. This indicates a very high field strength that the part has to operate under and operate correctly.

Again, there is no EU regulation or US regulation in this case, so this is really a Toyota unique test, based on our know-how. You'll see in the pictures the test setup is very similar – the large square shown to the back side of the photograph is the antenna that simulates the two-way radio or cell phone type – in this case, the bombarding the part with the energy.

The part is sitting on that blue pedestal, and it's operating under those conditions. The photograph on the right hand side shows a test technician bringing the antenna in close proximity to the part itself – that's the device he's holding in his hand – and agai