July 11, 2011

Louis Lanzerotti, Ph.D.
Chairman
Committee on Electronic Vehicle Controls and Unintended Acceleration
Transportation Research Board of
The National Academies

Dr. Lanzerotti:

I feel compelled to reach out to you and the Committee on Electronic Vehicle Controls and Unintended Acceleration as it prepares its recommendations to NHTSA. The February report prepared by the NASA Engineering Safety Center identifies, but dismisses, a weakness in Toyota's safety-critical system as a plausible cause of UA: tin whiskers.

I believe this to be a serious shortcoming. In your charge of reviewing past and current industry and government efforts to identify possible sources of automotive sudden acceleration, I hope you will consider my concerns.

I am a materials and process engineer recently retired from Northrop Grumman Electronic Systems (formerly Westinghouse) in Baltimore. I was responsible for expressing engineering requirements in the company's specifications for all processes used in manufacturing electronic products, and also for analyzing component and system failures. In 2002, I prepared a paper showing that the cause of several spectacular failures of a 25-amp relay, a component of an airborne radar system used by the defense departments of many nations, was tin whiskers.[1] Significantly, these failures occurred *many years* after the relays were built and installed.

Since that time, I have participated regularly in a weekly telephone conference devoted to tin whiskers.[2] Participants typically include the most experienced and authoritative engineers on this issue at many defense and aerospace electronic system manufacturing companies across the US (and NASA). Recently, two of my colleagues and I filed a provisional patent application for a novel method of preventing the growth of tin whiskers on electronic assemblies.

I am very concerned that the recent NHTSA/NASA-NESC report on Toyota Unintended Acceleration does not give adequate attention to the possibility that some unintended acceleration incidents were caused by tin whiskers. NASA's whisker web site features abundant examples of space-borne systems that failed due to whiskers of tin (or one of the few other metals subject to this phenomenon, such as zinc). But tin whiskers have also been linked to failures in ground-based systems such as pacemakers, nuclear reactors, electrical power stations, and computers.

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[1] G. Davy, "Relay Failure Caused by Tin Whiskers", Northrop Grumman Electronic Systems Technical Article, October 2002. http://nepp.nasa.gov/whisker/reference/tech_papers/davy2002-relay-failure-caused-by-tin-whiskers.pdf.

[2] Contact info for the convener: Bill Rollins, wprollins@raytheon.com.

The NASA-NESC report acknowledges that tin whiskers were found on Toyota potentiometer Accelerator Pedal Position Sensors. It also states explicitly that UAs are rare events. But the authors appear not to have recognized that **the cause of a rare event must be unlikely**: events precipitated by a "likely" cause would not be rare.

In fact, the NESC team found whiskers growing in every potentiometer APPS it examined. Because APPSs have exposed tin on component terminations, it is quite likely that *many* of these designs have tin whiskers. It is also likely that of those, *a few* have the necessary combination of two whiskers with the right resistance bridging between the right terminations to produce UA without setting a DTC code. While the NASA-NESC team did an admirable job *identifying* the tin whiskers in the APPS, their *analysis* was inadequate.

Discovery of whiskers is even more troubling given that the report confirmed that the APPS can have resistive shorts without triggering a fail-safe response. Regardless of the rarity, this signifies a flawed design that deserves further study. Until such study, tin whiskers should not be dismissed as an "unlikely" cause of UA. Since UA events are so rare, it would be better to dismiss the "likely" causes!

Rather than *statistically* analyzing to minimize these important findings, NHTSA and NASA should have *physically* analyzed more APPSs for tin whiskers, and sought further comments from the scientists who found them, to provide a better understanding of their significance for safety-critical automotive electronics.

As my colleagues and I have witnessed throughout various industries that rely on electronics, tin whiskers have resulted in both intermittent and permanent failures, most of them expensive, and some catastrophic. Dismissing the lessons learned from decades of study of tin whiskers and the failures and countermeasures employed by other industries in the case of motor vehicle unintended acceleration is too dangerous.

I urge you and your committee to examine the tin whiskers issue further to see how the DOT has gravely under-addressed it. That agency's assertions cannot withstand scrutiny, and must not go unchallenged. Lives are at stake.

Sincerely,

Gordon Davy, Ph.D.
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CC: Thomas Menzies, Ph.D.