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## The Law versus Reality

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## The Law *versus* Reality

As our lives come to rely totally on advanced electronics,  
our legal systems appear to still be in the steam age.

So how can they provide us with justice?

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Most engineers, and indeed most people, respect the law and assume that the proceedings of a court of law would have some sort of basis in reality. For example, that the court would at least acknowledge plain common sense, and the laws of physics (or “laws of nature”, if you prefer).

But those who have done Jury service, or acted as Expert Witnesses, may have a different view. Here are my experiences so far, which show that there is a huge mismatch, or gap, between the way the law works and what we need – in our increasingly technological society – to protect us.

### **The “absence of evidence” myth**

Since 2005 I have been providing Expert Witness services in legal cases. I haven’t done a lot of this work, and I can’t say that I enjoy it, because the usual rules of science and engineering – the basis for my profession – seem to be suspended, leaving me feeling very uncomfortable.

In the last couple of years I have started to get involved in “Sudden Unintended Acceleration” (SUA) lawsuits in the USA. Knowing nothing about it, I had always believed statements by the US Government’s National Highway Safety Agency (NHTSA), that runaway vehicles were simply caused by drivers pressing the wrong pedal, the accelerator instead of the brake.

In the mid-90s I realised that the engineering approach to electromagnetic compatibility (EMC) – the control of electromagnetic interference (EMI) – did not align in any way with safety or reliability engineering. Because there are now so many aspects of our lives that depend totally upon electronics working reliably, including many that are safety-critical, this seemed to me to be remiss, and so since 1997 I have chaired the IET’s Working Group on EMC and Functional Safety (although the IET was called the IEE then). You can obtain our 2008 Guide on the subject from [www.emcacademy.org/books.asp](http://www.emcacademy.org/books.asp).

Because of my involvement with this subject, I was asked to visit a successful US Trial Lawyer (in the UK we would call him a Barrister) to discuss providing Expert Witness services in SUA cases. Well, I was not at all sure that I wanted to get involved, and not sure what this lawyer could tell me that would be convincing.

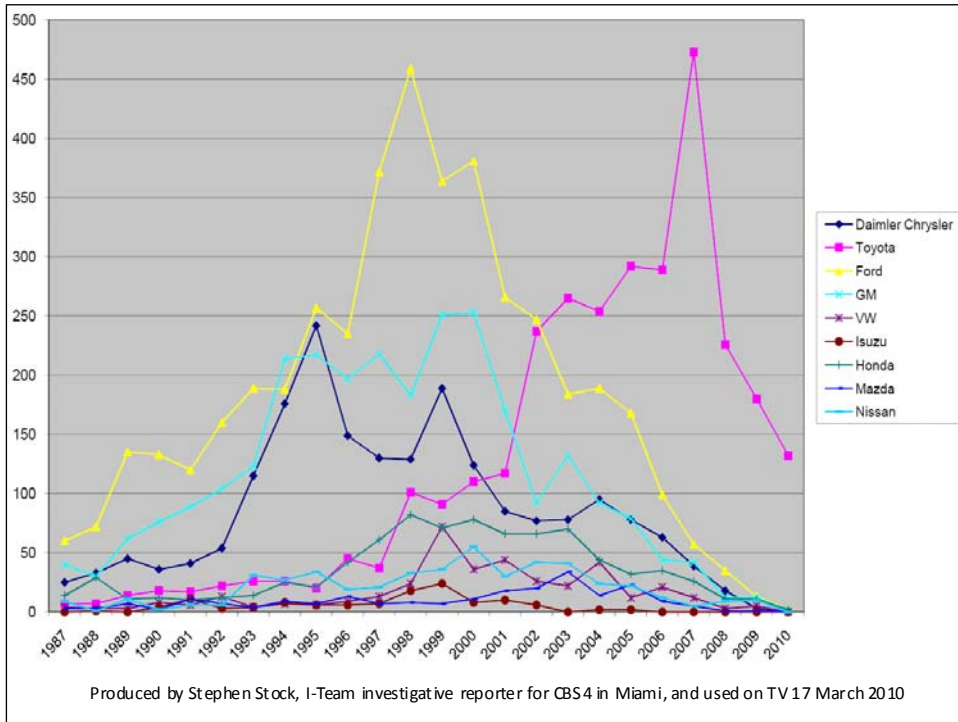
But SUA incidents are generally terrifying because they involve the engine roaring away at full power, and in some years NHTSA has received as many as 30,000 such complaints, and it seems that this represents only about one-hundredth of the real number of incidents.

SUA incidents can have horrifying results, including multiple deaths and injuries. If you have a strong constitution and don’t suffer from bad dreams, listen to the police recording of the call from a passenger in 19-year Highway Patrolman Paul Saylor’s car, at: <http://www.youtube.com/watch?v=KHGSWs4uJzY>. (Be warned, it is truly horrifying.) Mr Saylor had hired a 2009 Lexus ES 350 saloon and was driving his wife, 13 year old daughter and brother-in-law, when it suddenly accelerated to about 120 mph shortly before reaching a T-junction. The runaway vehicle hit a Ford Explorer, crashed through a fence, flew into the air, turned over twice and fell into the flood plain of the San Diego River, where it exploded in a ball of fire, killing them all.

As a professional engineer I could not turn my back on such an issue, and since the lawyer would pay my time and expenses to visit him, I thought “why not?”.

Well, I saw official figures that showed that SUA had never occurred until the 1980s, and then only occurred on cars fitted with electronic cruise controls or other electronic throttle controls, plus automatic transmission. Every car manufacturer suffered the same problem, but the number of official SUA complaints varied wildly between models. They would also sometimes increase dramatically when a model's electronics were changed, despite nothing else about the vehicle being changed.

Figure 1 shows a graph created by Stephen Stock, an investigative journalist for CBS-TV in Miami, based on the NHTSA database of complaints that concern "vehicle speed control" (NHTSA don't categorise their complaints, so unless a driver actually uses the words 'sudden unintended acceleration' the only way to find out if it is such a problem is to read the actual complaint and decide what you think it represents). Clearly, "pedal error" cannot account for variations like these.



**Figure 1 Graph of speed control complaints versus some major automobile manufacturers**

All the curves in Stephen's graphs decline towards zero at both extremes of the time range, but this is an artefact of the data. Complaints are logged by the "Model Year" of the vehicle, and not by when the alleged incidents occurred. In 1995 NHTSA moved from a paper-based recording system to a computer-based one, and did not transfer all the paper data. That's why all the graphs tail off below 1995. And they appear to tail off at the modern end, because complaints from a given model year aren't all in until at least 10 years after its last sale. The NHTSA data is all publically available via the Internet.

As an engineer involved with electronic product design and manufacture since 1968, it was immediately obvious to me that there must be a problem with the cruise control or electronic throttle electronics. It couldn't possibly be "pedal error", and I know that electronics could malfunction, with or without EMI, so if they are controlling an engine's throttle valve, they could have failure modes that included forcing the throttle wide open.

So I agreed to provide my services in such cases, to show juries that there is an alternative possibility to the "pedal error" theory of the cause of SUA. I naively thought that what was so very obvious to me (and to any electronic engineer, or at least all of the one's I've ever discussed this with) must be just as obvious to anyone else. Boy, was I ever mistaken!

The biggest barrier, I soon found, was that NHTSA, the US legal system, and Judges and Juries, seem to believe the myth that *if no fault could be found after an SUA incident, then it could not possibly have been a fault that caused it.*

In our modern world, most of us use computers, which will now and again stop working. We press the reboot key or turn the power off and on again, and it starts up again and works perfectly. But how

could you prove to anyone that this actually happened? After all, the computer is working properly now, with no visible damage to its wires and printed circuit boards (PCBs).

Despite this sort of thing being a common experience, and not just with PCs but with other electronics, trial lawyers working for the defendants in SUA cases in the US always use the argument that because official investigators can't find any evidence of a malfunction in the electronics, therefore there can't be anything wrong with the electronics and therefore it can't have caused the SUA.

(And official investigators don't look very hard either – they don't check the PCBs for hairline cracks in their solder joints, and they don't slice open the integrated circuits and use electron microscopes to see if they have similar internal problems. They just look for damaged wiring, burn marks from arcing, that sort of thing.)

When working for an electronics company, if customers complain of a serious safety-related malfunction we investigate our design to see if it could cause that malfunction. If we find that it could, we change the design to stop it happening again. On the cruise controls and electronic throttles for which I've been provided with sufficient technical data, it is clear that they could fail, or be interfered with, in a way that could cause an SUA, and I've even seen Failure Mode and Effects Analysis (FMEA) documents from the manufacturers of vehicles and their components for some of them, that found similar problems (but didn't correct them!).

But in a US court of law, the arguments by defendants' lawyers that because an official investigator can't find any evidence of a malfunction in the electronics, *therefore* it couldn't have been the electronics that caused the SUA, is always an acceptable argument.

The problem seems to be that what – in my professional world – is the normal understanding of how things work, is not the understanding of the Judges and Juries. They are not electronic professionals, and want to be convinced. But they might just as easily believe claims that are completely false, as those that are true, because they have no basis of understanding what is being discussed.

That is my first example of how the law departs from reality.

How can we (people or organisations) possibly be protected from others – if the law simply doesn't understand the basics of electronics?

The fact that Judges and/or Juries have to decide for themselves, how electronics works, or how it might fail, by deciding who to believe, means that the law is adrift from reality.

For more on the silly assumption that absence of evidence of an electronic malfunction means that the electronics cannot possibly have malfunctioned, see my article on this topic in Issue 78 of the EMC Journal, September 2008 (from the archives at [theemcjournal.com](http://theemcjournal.com)).

### ***The “fairy dust” myth***

Like most electronic engineers, you might think my example based on a PC should be reasonably persuasive, but you would be wrong. I know that the electronics used in cars has exactly the same sort of behaviour as the electronics used in PCs and everywhere else – at the level of the transistors, resistors, capacitors, inductors, conductors, electric and magnetic fields, etc.

When we want our electronics to be more reliable, or more immune to EMI because of safety risks, we have to design it so that it behaves reliably enough in its intended environment, over its anticipated lifetime. Whether we did a good enough job or not will usually be made obvious enough by an inspection of the design drawings and code listings, by someone with the appropriate knowledge and expertise.

Design and construction approval by an *independent* safety assessor is exactly how the aircraft or train in which we recently travelled was determined to be safe enough, by law. But motor cars are not subject to the same safety rules, and can be sold without a requirement for any documented safety assessment, never mind an independent one.

In the USA, when a plaintiff's lawyers attempt to find out about the design or construction of a certain vehicle, they are faced with all sorts of difficulties in obtaining the correct documentation, which may even have been shredded. So cases often seem to go to court with little detailed understanding, much less any independent safety assessment.

My job, as an Expert Witness in SUA cases, is (apparently) an easy one. At least, that was what I thought at first! All I am supposed to do is show “general causation”, that malfunctions and EMI in the electronics that controls the throttle valve, could be a cause of SUA, along with pedal error. Then at

least the Judge or Jury can decide which they think is the most likely, given the circumstances (e.g. whether a witness saw that the brake lights were on as the vehicle raced away).

I am not expected to show that an electronic malfunction actually *caused* the alleged SUA, partly because of the difficulty of actually finding out sufficient design details for the vehicle concerned. I merely have to show that it is possible. But automakers' lawyers claim that simply because I can show that all other uses of electronics can suffer from malfunctions, including those caused by EMI, does not mean that a given cruise control or electronic throttle can behave in a similar way.

Automakers' trial lawyers expect people to believe that there is some sort of magic "fairy dust" (known as "pixie dust", in the USA) that an automaker can sprinkle during manufacture, that can completely alter the way their transistors, resistors, etc., behave in real life.

They won't tell you what it is, claiming that it is commercially sensitive information that their competitors must not find out. We are just expected to take their word for the fact that they can do it.

To me, this whole idea is, of course, a joke. And not one in very good taste. But Judges and Juries are not safety engineers, so have no way of knowing that relying on "assurances" from a manufacturer who has a vested interest, is not how safety assessment is done in almost any safety-related industry, other than automotive.

### ***The myth that EMI is not a real topic***

Here is a direct quote from a legal document produced by lawyers for one of the major global automakers, dated 4<sup>th</sup> June 2010:

"Plaintiff's new claim that the entire cause of all unintended acceleration cases is the heretofore unknown phenomenon called Electromagnetic Interference ("EMI"), and that EMI is a "hit and run" defect leaving behind no evidence that it had struck. .... This is demonstrably false."

This claim, that EMI is just an invention of certain individuals called as Expert Witnesses, with no basis in fact, has been a staple of automakers' trial lawyers for decades. I have many similar documents that claim that the theory that EMI could possibly be a cause of SUA is "Junk Science".

What makes such claims even weirder, is that the automakers involved own large and costly EMC test laboratories, and impose their own EMC specifications on their component suppliers!

But once again, Judges and Juries are as likely to deny reality by believing such myths, because they have no experience in the electronics industry.

What happens, in these court cases, is that *the Jury decides what they think are the laws of physics*.

All electricity and electronics are governed by Maxwell's equations, which also show that EMI can occur, and yet each jury in each SUA case, is expected to decide whether to believe this or not.

How can they possibly be expected to do this? It is obviously completely unrealistic to expect ordinary, well-meaning people, to make decisions about the laws of physics.

I hope that I have started to scotch this type of claim in future, by submitting the official set of CD-ROMs of 50 years of IEEE EMC Symposia records (1947-1997) as "exhibits" in the cases I am involved with.

### ***No engineers wanted on US Juries***

I was discussing this very issue with some US engineers at the IEEE EMC Symposium in Fort Lauderdale, in July this year, and they told me that no engineer ever does jury duty in the USA. Trial lawyers in the USA can object to certain jurors, and get them replaced.

Apparently, once they know you are an engineer, one or the other set of lawyers will object and you are off the case.

Why? I leave that as an exercise for the reader, but maybe some lawyers actually prefer for Juries to decide for themselves what the laws of physics are, unhindered by any actual understanding?

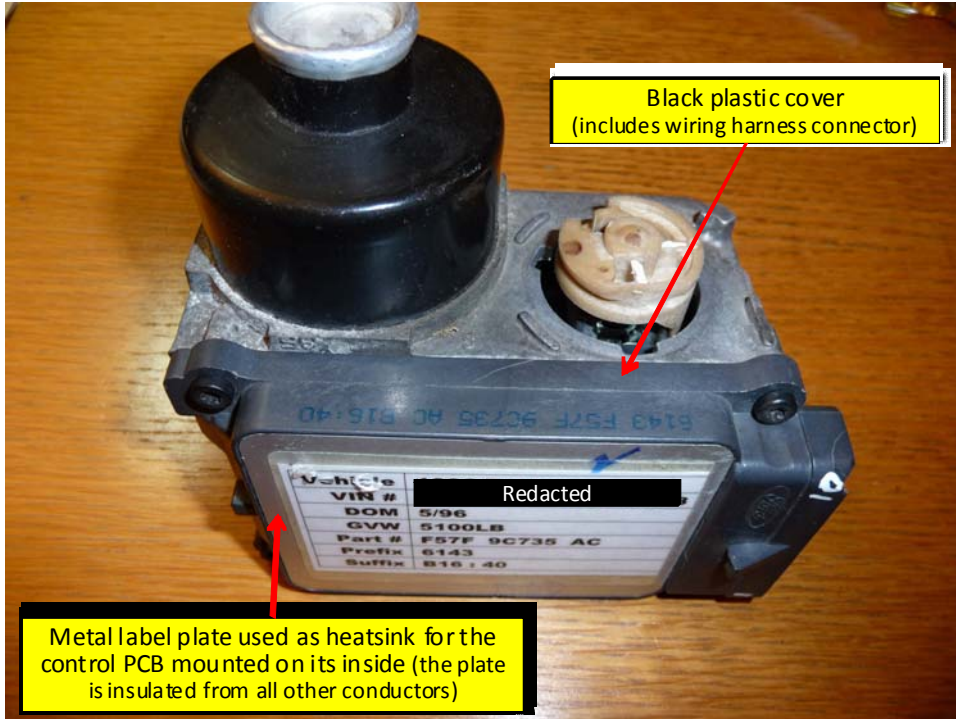
### ***The myth of total shielding***

Because Judges and Juries are not experts in electronic, EMI or safety engineering (but how could they be? Especially when any such engineers are thrown off Juries.) some people seem to feel that can make outrageous statements, and if they say them with enough force or confidence they will be believed.

For example, here is a direct quote from a legal document produced by an expert witness (said to be an EMC expert) for one of the major global automakers, dated 30<sup>th</sup> October 2009:

“The entire electronic mechanism is packaged in aluminium-shielded enclosure to eliminate any external effects of electromagnetic interference.”

Leaving aside the idea that anyone could ever say that any shielded enclosure could ever *eliminate* EMI (it is certainly possible to make one that is good enough to meet acceptable levels of functional safety risk, but *eliminate*?) – Figure 2 is a photograph of the electronic unit in question.



**Figure 2 The unit that “can’t suffer EMI”**

Figure 2 (taken on my office desk) shows that the unit has a plastic cover completely over one side, and one large holes in its upper side (another one is hidden by the circular plastic cover).

All of the EMC engineers reading this are probably open-mouthed and shaking their heads that anyone could ever claim that the unit in Figure 2: “...is packaged in aluminium-shielded enclosure to eliminate any external effects of electromagnetic interference” but the person who wrote this, and the automaker’s lawyers who have been employing him as an expert witness for over ten years in SUA cases, clearly believe they have a good chance of persuading a jury that what he claims above is true.

All the above quotes are from public documents in the US legal system, and the lawyer who employs me as an expert witness over there says they can be freely quoted in the media. But I’m not a legal expert, and don’t know if the same rules apply to publication of these documents in the UK. So I’m playing safe in this article and not giving all the details that I could.

**Legal myths in the UK**

Its easy for us on this side of “the pond” to poke fun at legal goings-on in the USA – but in my limited experience we have no reason whatsoever to feel superior.

The problem with non-technical jurors has been recognised in the UK, and we have special courts for certain highly-technical cases, which only have a Judge who is supposed someone capable of understanding complex technical subjects.

But this has resulted in one case that now threatens the livelihoods all subcontractors and consultants in the UK – they can now, by legal precedent, be held liable for *the total financial losses of a company*, if the Judge believes that there is a relationship between the financial losses and the work done by the subcontractor.

I have seen the summing up by the Judge in the case concerned, which shows that he really had no clue at all about the nature of electronic technology or how it is practised in the real world.

Although the PCB design subcontractor had his work approved by his customer’s senior electrical engineer, the Judge ruled that he was liable for all the losses suffered by the company as a result of poor reliability of the PCBs he designed. His business, car, home, etc. were all forfeit and he was totally ruined.

This is the sort of thing that all subcontractors always understood could never happen under UK law. Once the customer has accepted your work, it becomes their problem. If they didn't understand their own application well enough when they accepted your work, well that's their problem too.

But this legal precedent changes this understanding and is (I am told) now being used in the UK to screw small subcontractors for corporate losses (claimed to be) worth many millions, even when the total liquidation of their assets only results in a few hundred thousand.

As a result of this legal precedent, consultants and subcontractors in the UK, who are not limited companies, now need to ensure they have enough professional indemnity insurance to cover their customers' possible losses, but once you get above cover worth £1 million the premiums rise very steeply. And they probably also need to get their customers to sign legal agreements that limit their liability in the light of this legal precedent. Maybe the easiest thing is to convert to being a limited company, with a small amount of share capital.

### **Conclusion**

It seems obvious to me, that the legal systems in the UK and USA simply are unable to deal correctly with issues of technology, and never will be able to without massive and radical reform.

I can't comment about other countries, maybe they have better systems, but if the person or people who decide the technical issues are not peer-approved independent experts *in very field in question*, it's just not going to work. Justice isn't going to happen.

Maybe we would consider turning to the relevant Professional Institutions to provide the appropriate experts. A team of experts would make the decision, not a Judge or a Jury.

So, it seems to me that, at least in the UK and USA, no-one – whether an individual or a company of any size – can have any reasonable expectation of receiving justice where a case involves the correct operation of electronics or other high technologies.

At least, not as long as the people who decide are allowed to make their own minds up about what are the laws of physics, on a case-by-case basis, as they do at the moment.

Keith Armstrong is a member of the EMC Industries Association, [www.emcia.org](http://www.emcia.org).

