

Lightning & Modern Airliners

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Modern airliners are far more likely to be downed by lightning than the older airliners that were flying over 50 years ago.

I have a pilot license; an airframe and powerplant mechanics license and before I retired, held a first class radio-telephone license so I know these facts well that I'm about to relate to you here.

It's getting to be 'fly by wire' today; it wasn't 50 years ago with the Boeing 707 and DC-8.

The airliner of 50 years ago was built like your car where all the controls were activated by human muscles and this force transferred to steel cables plus hydraulic power being added to assist; just like the power assisted steering on most of today's larger cars, trucks and busses. This method has proven to be reliable for land, sea and air transportation.

Then in the 1960s an entirely new computer oriented method of controlling the airliner started to manifest itself. This we all knew as 'fly by wire'.

To the best of my knowledge it began on military aircraft and then found its way, in a partial method of control, to the Boeing 737 airliner. Now it's the preferred method of total airliner control with more and more 'fly by wire' features being incorporated into every new airplane. Airbus engineers have designed their aircraft to be solely 'fly by wire' and now the Boeing 787 will exclusively be a 'fly by wire' airliner with computers flying the aircraft and no more human activated control cable systems. It's as if the 787 design engineers simply dragged all manual control cable systems to the trash and deleted them. While this may be OK for the military, who have parachutes and much of whose aircraft must be flown by computer, this works fine but it's a big mistake to design civilian

airliners as *exclusively* 'fly by wire' airliners with no human mechanical method of back up control available.

In fact I think this is criminal behavior on the part of our airline industry.

You must give the crew a back up method to control the airliner when 'fly by wire' fails. And eventually 'fly by wire' will fail!

Today modern airliners are getting to have fewer and fewer cable driven systems and getting to be more and more 'fly by wire' where a computer actually controls the airplane while also providing a synthetic feel to the pilot to make him *think* he is really flying.

There are reasons for this because in many cases the pilot simply cannot react fast enough: An example of this is 'yaw damp' where without a yaw damp computerized control, a Pan American 707 airliner, full of people, turned completely upside down and was very nearly lost over the Atlantic ocean in the early years, as we learned what can happen to airliners with sweptback wings.

So we opted for the tremendous strides that computer 'fly by wire' gave us.

BUT --

-- what are the consequences of making this method *exclusive* when we look at what lightning can do to the airliner?

One night, many decades ago, when I was in charge of radio and electrical on the 2nd shift at Airlift International, an all cargo DC-8 pulled in at the cargo area of Miami International airport, and I pushed a tall steel stand to the aircraft cockpit door. I liked to talk to the crew first hand about any radio or electrical problems because what they said and what they actually wrote in the log sometimes differed quite a bit.

One of the crew immediately opened the door and ran down the steps of the high steel stand saying, "Let me out of this casket!" He was gone in a flash!

Flying the plane was Captain Applebaum. I knew both him and his wife very well for years. They both used to come into a store I had on the circle in Miami Springs, Florida.

Applebaum's DC-8 cargo airliner hit a bad lightning storm over the Atlantic.

A DC-8 is powered by 110 volt 400 cycle **alternating current (ac)** delivered from four alternators on each of the four jet engines. The aircraft's battery is there mainly to light instrument lights and operate some relays.

A Lightning strike **melted all four** alternator fuse-links (each containing a strip of a silver metal alloy as thick as a teaspoon handle), This meant **all** 110 volt **ac** power was gone!

On the DC-8 **everything** is actuated by 110 volt **ac** power. It even powers rectifiers for the many direct current (dc) needs which the small shoebox size Nicad battery could not possibly supply all by itself for very long.

All the inside lighting was gone. They had to use flashlights. Applebaum couldn't even switch fuel tanks because all the fuel valves needed **ac** to operate. He couldn't even radio out because all that needed **ac** as well.

Applebaum was very lucky because this particular DC-8 had come from Alitalia and they had installed a French artificial horizon that would run for twenty minutes without **ac** power.

Applebaum was left with only three other instrument systems that were properly working and lit: He had a magnetic compass. He had the four EGT (exhaust gas temperature) indicators and the four turbine rpm indicators because they were driven by their own electrical generators.

He had **no** other instruments that worked reliably and consistently during the twenty minutes of time that he had to fly the airliner devoid of **all ac** electrical power. (*He lost all reliable airspeed indications as the pitot tubes froze up because of no pitot heat.*)

But he successfully flew the airliner this way for twenty minutes while the co-pilot and flight-engineer left the cabin and used their flashlights to take down three fiberglass seven foot high panels and replace the four melted fuse-links, which they luckily had spares for aboard.

These fuse-links, by the way, were put in to protect the aircraft alternator wiring from bad exterior ground power units that, when plugged in, failed to sync into

the aircraft power system. No one had intended them to melt with lightning but by melting they had indeed saved the alternator electrical wiring.

After replacing these fuse-links, the flight engineer had to parallel the four alternators and this entire process completely took up the twenty minutes that the French artificial horizon was designed to run. Without that French horizon running for those twenty minutes, they would have lost the airplane because they were still in the storm.

I know all this to be a fact. This is absolutely true!

I've told this story many, many times to many, many people in the aircraft industry and, from some, have received laughs and replies that "Lightning couldn't possibly get inside an airliner to do all that."

But it did do it.

Applebaum came through it because the DC-8 was not a 'fly by wire' aircraft but instead it was controlled by muscle strength that gets put on control cables which actuate the controls much like the power steering in your car using hydraulic pressure via the engine driven hydraulic pumps, essentially the same way it's being done in most vehicles today.

Applebaum's DC-8 could continue to run a full twenty minutes - *and even longer* - using no electrical power. Your car won't even do that. It needs voltage for the ignition but those jet engines on the DC-8 didn't. They even pumped in their own fuel without needing any electricity whatsoever.

Airliners are simply not constructed nor controlled that way anymore. The old human muscle strength plus hydraulic power actuation - the way Applebaum did it - is 'gone with the wind'!

Most modern airliners, instead of using the old human muscle plus hydraulic assist power, are now mostly electrical computerized 'fly by wire' devices that simply can fail when all electrical power is lost.

If you think the airplane battery is going to help, in this situation, better think again.

We gained tremendously by allowing the computer to take over and fly. It controls everything far, far better than humans possibly can.

That is -- as long as we refrain from going through severe lightning storms.

If lightning can knock all the electrical power out of a DC-8 then it most certainly can knock all electrical power out of any airliner, even a 787.

Do I think exclusive 'fly by wire' control is best for military aircraft?

My answer is an absolute yes!

And 'fly by wire' is fine for civilian airliners too as long as it is **not** exclusive and it can be **manually over ridden** when the computer fails when all electrical power is lost - *via lightning*.

Do I think this aviation industry feels it is in their best interests to keep the public in the dark about the dangers lightning can cause to their exclusive 'fly by wire' control systems?

My answer is also yes!

Do I think this aviation industry has even far more power in keeping the public in the dark about their products than even the tobacco industry?

My answer is yes!

Do I think some modern airplanes are more vulnerable to lightning than others?

Another yes answer because in the Boeing 777 the pilot can override a damaged computer's '*envelope of control*' but in the competing Airbus series he simply cannot. When all the Airbus computers fail - *via lightning* - then all control for that airliner fails. We **must not** allow such airliners to continue to be built where there is absolutely nothing the flight crew can do and that airliner is simply destined to crash - *via lightning*.

New composite materials, on these new aircraft such as the 787 are replacing the aluminum that used to be used. Aluminum was an excellent shield against most lightning strikes affecting inside wiring. Will it be even more disastrous to fly a

composite built aircraft into a lightning storm? The jury is still out on that one.

An evaluation must be made of all our modern airliners as to how affected by lightning they really are and whether they can be controlled in the event of a complete loss of electrical power after a severe lightning strike knocks out all electrical power and computers.

My opinion is that the aviation industry is greatly downplaying the role of lightning in safety today much like the German Zeppelin industry downplayed the danger of hydrogen gas in the 1930s.

The Hindenburg tragedy proved to us that this aviation industry will continue to build larger and larger unsafe aircraft designs until the slate gets wiped clean of all the company advertising hype and the malarkey of the military industrial complex. It is only then that the public finally sees the truth and gets aroused *after* a massive, highly publicized loss of life.

I suppose this is the way things have to go *before* the aviation engineering folks drastically change the design of airliners so that 100% of them are lightning safe and able to be controlled after a severe lightning strike knocks out all their electrical power.

That French Airbus - that killed everyone in the Atlantic - gives a perfect example of what happens when wrong info, on today's aircraft, is fed to the aircraft's computer. All the Airbus pitot tubes froze up telling the computer that the aircraft was no longer flying. The crew probably had **less than a minute** to put the aircraft in a safe 75% power mode but they failed to comprehend the problem in those few vital seconds that the Airbus designers had allotted them to figure the problem out and everyone on that plane died.

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Also see: <http://www.amperefitz.com>

and: [*Schrödinger's Universe*](#)

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