STATE OF THE ART as PROBATIVE EVIDENCE

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In a less archaic vein, a law case concerning an airplane crash was put into settlement position by among other things proving that the designer of a new airplane knew *or should have known* of a certain safety feature built into a World War II airplane but left out of the design of the modern craft. Here is a description of one facet of the 1970 case.

"From a system safety standpoint the engineer is tasked to design his product with safety in mind. It is a well-quoted axiom that a system safety engineer designs out the hazards while the new widget is still in a paper and design prototype phase.

"To help him in his judgments concerning the new widget he will utilize a 20–20 crystal ball, namely engineering experience, and tools of his discipline such as Failure Modes Analysis , Failure Modes and Effect Analysis , Fault Tree Analysis, and Lessons Learned.

"It is far better to predict and eliminate hazard than to discover hazard as a result of an accident investigation. The experience in this case will demonstrate that fact.

"Now Fault Tree as well as Failure Modes and Effects studies are all, to an extent, based on supposition; Lessons Learned is as a result of understanding a historical failure or tragedy.

“In the law, a manufacturer may be given latitude and some relief from extensive testing if the newly designed widget is substantially the same as an older one where testing was complete and safety seemed inherent. This precept is true for copy-cat drugs, for certification of aircraft and for many designs of most widgets.

“The converse is the case when the widget is a departure from the SOTA (Art) or SOTI (Industry), that is, State-of-the-Art or State-of-the-Industry.

“Now, as an example, if all we are going to do is switch an automobile from an aspirated engine to a fuel injected engine and by so doing achieve 10 extra horsepower, we may not have to test the entire vehicle again. Possibly only pollution emissions may need testing.

“It is when you totally depart from the State-of-the-Industry and attempt to introduce a new and radical design that you as a manufacturer have a duty of full testing and even unique testing. This new product requires stringent analysis and test.

“Part of that duty to test includes researching the State-of-the-Art, which requires a look at Lessons Learned from previous but similar designs or applications.

Cessna a manufacturer of General Aviation Aircraft, introduced a radical new aircraft in the mid 1960’s. It was a twin engine, twin boom aircraft with high-mounted wings and retractable landing gear. Mounted facing forward was a center-line reciprocating engine. Aft of the passenger compartment was a second, rearward-facing engine with a pusher propeller.

"The wonderful simplicity of this aircraft as advertised by the manufacturer was the idea that if a general aviation pilot loses a wing-mounted engine on an ordinary twin-engine aircraft, the aircraft yaws terrifically at low take-off speeds and a novice pilot would have his hands full.

"Cessna advertised their plane with words similar to: THE CESSNA 337, Every man's P –38, Lose an engine, It is a piece of cake, with the center line mounting there is no yaw, so continue straight ahead like any single-engine airplane.

"This seemed a good idea except that there were several incidents and accidents where the pilots had attempted take offs with failed rear engines. In the civilian design the engine instruments were not of optimum design or location and the pilot by design would not feel the loss of an engine with no Yaw. Moreover, the location of the engine made it difficult to hear loss of power or see prop rotation stop.

"In addition, some theorized that the rear engine housing design was such that engine failures due to air circulation and intake problems seemed greater in the rear than the front engine.

"In our lawsuit we suggested that because of the poor instrument design and layout, and because of the inability of the pilot to see or feel the loss of a rear engine, he was unaware of his rear engine failure. We suggested that the airplane should be equipped with a rear-engine-out warning ***light***. Our expert Instrument Designer's suggestion (an Aviation Psychologist from Wright Air Development Center, Dr. Walter Grether) was that the aircraft be equipped

with a distinctive aural warning, a master red blinking caution light mounted in the straight-ahead cone of vision, and a red light within a feathering switch for the affected engine. Cessna maintained that this improvement was not needed.

"I was on layover from flying an airline trip when I visited a bookstore in Ann Arbor, Michigan. It was there that I found a book with a picture of a Nazi fighter plane on the cover. It was a piston-powered Dornier 335 Pfeil (Anteater) aircraft. The amazing thing about this aircraft was the fact that it had one engine mounted in the nose and another pusher engine and propeller in the tail.

"As I picked the book up, I realized this was the only other centerline-mounted prop plane in existence. The United States shortly after the war had a half jet – half prop plane called the Ryan Fireball. This then was the genesis of the centerline thrust –low drag machine that Cessna was replicating. I paid for the book and took it back to the hotel.

"To my amazement I read that a very early prototype of the Dornier 335 had crashed due to a test pilot attempting a takeoff with a failed rear engine. It was a fatality. Nothing more was said about that pilot or that accident. I decided find out what the State-of-the-Art was in 1942 and whether Cessna should have known.

"I called the Smithsonian Air Museum and they said they indeed had the only Dornier 335 in existence, but that I better hurry because they were getting

ready to ship it back to Dornier factory for a restoration and then it would reside in the Luftwaffe museum for ten years.

"I called Adolph Galland -- then president of the Luftwaffe Fighter Pilot's Association and the all-time world's leader fighter pilot ace. He placed me in contact with a former test pilot and I learned an amazing story about the aircraft. AFTER THE FIRST FATAL ENGINE-OUT TAKEOFF the Nazis designed and subsequently installed an engine-out warning light called a FUEHRER Warning Lamp. It was installed in the cockpit for the pilot. Dornier in 1942 had learned the hard way what Cessna had not.

"An Interesting story –yes, but how did it tie into ***the manufacturer***? As it turned out, after the war Cessna as part of the rebuilding process was to help Dornier re-enter the aviation marketplace. Cessna engineers were interfacing with Dornier people at their factories. I noted that the numbering system for the push-pull Cessnas seemed awfully coincidental.

"The Dornier number was 335 and Cessna chose the Numbers 336 for their fixed gear push-pull aircraft and 337 for their retractable gear HUFF and PUFF. (The latter nomenclature developed as a slang name for the Cessna front-engine/rear-engine plane.) The numbers 336 and 337 were seemingly out of sequence for Cessna.

"The case settled, and we suspect that a Lesson that should have been learned came back from a 1942 accident and reminded them to be ever-vigilant in not forgetting Lessons Learned."