

# Computer Simulation

Capt. M.P. "Pappy" Papadakis JD  
© 2013

Demonstrative evidence is often the key to persuading a jury. After you have retrieved documents from the various centers and sources, you need an effective way to present that data to a jury.

The data itself is in the form of a myriad of pages of computer printouts. This is totally non effective.

Charts and graphs are good, but sometimes they are cluttered and confusing. It has been said that a photograph is worth a thousand words. There are other methods to present effective visual depictions such as computer generated video, flight simulator video, and actual flight test video. Each will be discussed.

Regardless of the type presentation, there are underlying requirements of evidence that must be followed in order to get the demonstrative evidence into evidentiary form that the jury will be allowed to see. Generally speaking, the rules that will suffice are simple:

- A. The underlying data from which demonstrative evidence is made up must be admissible and admitted. Usually you can get the flight data, cockpit voice recorder and radar tape data admitted simply by having a certified blue ribbon copy provided by the government.
- B. You must have the author or an expert of the demonstrative evidence attest that the demonstrative evidence as presented is an accurate depiction made from unaltered data points derived from admissible evidence.
- C. Generally, you will provide an expert witness to narrate and explain the computer generated demo tape.

A flight reconstruction analysis can be presented in many various forms:

1. From inside the cockpit - showing what the pilot saw - with particular instrument readings shown digitally at the side such as: altitude, airspeed, heading, dive speed, dive angle and angle of bank.
2. From behind the aircraft with the same readouts printed digitally.
3. From a position above with the flight track plotted on a map or overflying computer generated terrain with the same print outs.
4. Certain instrument readings may be highlighted.
5. Combinations of each pictorial may be played split screen.

The newest technologies to make such displays are laser disc instead of video tape. Laser disc stop action, is clearer than the pause function of normal video presentations. With Laser disc CD's you get instant rewind, stop action and immediate picture shifts on command. For the courtroom you should always chose the largest screen available with high-resolution picture and a bright picture.

A computer reconstruction of about 15 minutes duration done by a reputable professional production company will cost in the neighborhood of \$10,000 with additional expense for deposition, trial and travel expenses. It is worth every penny.

A sloppy tape can be the worst possible harm to your client. Once I saw a cheap video reconstruction where the voice told the pilot to turn left. The map presentation turned left, but unbelievably the visual went the wrong way! Pay the price and get it done correctly.

Often times a video such as this can backfire on the attorney presenting just such demonstrative evidence. The producer of the data will naturally only include the most useful data for simplicity and clarity sake. Thus, many cockpit instruments will be left out and secondary data will be left out of the digital readouts.

The technician who designed the demonstrative data will know what he included

and why it was included. He may not be very well versed on what data was omitted and why. A good cross-examiner may destroy the probative value of the video demonstration by implication that they were hiding something by omitting it.

I was able to use this method in cross-examining a scale model maker who had been tasked to replicate a full size model of an A - 10 cockpit. I had the model maker come down off the stand and place stickers everywhere on the model that he had left out a part shown on blueprints, and to put further stickers everywhere they had had flight control problems. By the time the model maker had completed my cross examination the model looked as decorated as a Christmas tree and the opposition weren't real anxious to have the jury examine the \$25,000 model up close.

In another case relating to the aerodynamic flying capabilities of a very well known fighter plane we cross examined the expert about the software program and the computer used to run the software. He stated that he had run it on a home pc--the "Commodore 128." Asked if that was the kind of computer that you could buy at "Toys Are Us "He admitted that you could, pass the witness, thank you very much.

These computer-generated videos are very useful in other aspects of demonstrative evidence relating to system and components of the aircraft. You can generate three view blueprints that magically transform into a 45-degree engineering drawings that appear three-dimensional. You can then add layers of parts from inside to out and then back again. You can show the moving parts of valves engines and pumps in a cross section cutaway fashion that is easily understood.

We had ordered just such a video of the construction of a B - 52 fuel pump, showing its blueprint, construction, operation, defect and then depicted the lack of heat transfer between carbon bearing and shaft. In what was to have been one twenty minute presentation we would have been easily able to educate an average jury as to the complex heat transfer problems in a sophisticated aircraft fuel pump that was

running dry and overheating. If a picture is a thousand words a video of this nature is a million pictures in value.

If experts tried to explain the same things from blueprints, pump parts, pump tests, and the accident parts it would take a week, at least three experts, and even then the jury would be confused. As a practical matter, the old-fashioned way would take longer, cost more, and technology transfer in understanding of the jury would be less.

Computer generated videos however are just like computers. Garbage in garbage out. In order to get meaningful data out you must insure the system is accurately and completely programmed on appropriate software. A computer generated graphic is simply regurgitating that which it has been empowered to do. It is a most useful tool.

### **FLIGHT SIMULATORS**

Many aircraft have flight simulators that are used as procedure and flight trainers. These expensive flight simulators are equipped with motion, sound and visual presentations. Some are so good that a pilots entire check out can legally be accomplished in the simulator rather than a real airplane. Simulators so certified by the F.A.A. are so good that a Captains first real landing in an actual aircraft may be accomplished with paying passengers aboard.

The actual math modeling provided the simulators computer have all been derived from or validated from actual test flight results. Thus the simulator simulates the real airplane in every facet of performance and handling throughout all regimes of flight and all regimes of emergency conditions within the flight envelope. Flight simulation is an extremely useful tool in the accident investigators bag of tools. The best thing about a simulator is that you don't get dead when you screw up.

If you recreate the flight path as derived from the reconstruction of flight recorder and radar data you immediately see what the pilot saw and what decisions he

was faced with. In the Harduvel F-16 loss of flight instruments, we were faced with what conditions of flight were needed to get the aircraft from a 45 degree banked turn into the ground 65 degrees nose down in about ten seconds. As an ex A-4 pilot I surmised that he would have had to roll upside down to at least 135 degrees of bank and then pull back on the stick to keep positive g forces on the airplane. When General Larry Welch the Chief of Staff of the Air Force actually gave us access to the Macdill A.F.B. F - 16 simulator to conduct our tests in, it became obvious that the airplane had gone almost inverted before he pulled back stick into a dive rather than a climb.

The pilot was a Topgun and an instrument instructor and it seemed preposterous that he would do such a thing if his instruments were working. Wreckage review had shown that all his flight instruments had failed or were giving erroneous readings at impact.

In a DC-8 crash we used a simulator to show that the only way a DC-8 could complete a three standard rate turn at altitude without increasing "G " forces was to get a tremendous yaw. You get such a yaw from outboard engine failure or reversal and by rudder hard over.

Wreckage review showed that the engines were in normal condition producing forward thrust. The rudder was found in a manual reversion mode that is the mode to be selected if you have a rudder runaway or hard over. The only time the DC-8 rudder hard over is sufficient to through the aircraft out of control is in slow flight flaps down. Wreckage review had shown that the flaps were down 25 degrees. When we attempted to fly the simulator in the rudder hard over, flaps down condition the simulator performed and crashed exactly as the real aircraft had.

The simulator is very important for even another reason. The switches and handles, alarm systems and enunciators are identical to the real aircraft and each is an exemplar of what is present in the real bird. Thus, an investigator should video tape

each test maneuver with sound on. This tape should be compared to the cockpit recorder for similar sounds (more on sound analysis). The simulator is also a very good computer and it stores and can print out parameters of the testing accomplished. In fact, a real time video can be made of the simulator instructor's panel and monitors.

In accidents where a simulator exists for the model and make of the accident aircraft it may be advisable to test fly a simulator through all accident scenarios. It's a hell of a lot cheaper to be wrong in a simulator than in front of a jury riding an impossible theory. Video tapes taken in a simulator require the same standard as other scientific tests, except that the simulator is already government certified as accurate for the type aircraft. Generally, all that is required is an attestation that the simulator was certified and calibrated as well as an expert to testify about the tests.

Actual flight-testing is very effective in front of a jury. It is a particularly useful tool for the defense to employ. Often they will place their test vehicle in the same or similar condition as the accident aircraft. Their test pilot will then demonstrate that the aircraft performance was such that the accident could be avoided. The implication of course is that the resultant crash was due to pilot error and not aircraft performance capability. Often these tests can be negated by effective cross-examination. Usually performance tests are conducted at safe altitudes, and the results are then translated to the actual conditions. For instance, a prop reversal was believed to have caused an accident on approach. A test flight was conducted at altitude where the prop was reversed and the pilot could recover without control loss. This test flight was damaging evidence to the plaintiff's position until on cross examination it was revealed that the test pilot would not try the same test close to the ground because it was too dangerous!

Actual test flights are very effective courtroom evidence; they can be filmed from the

cockpit and from a chase plane. The downside is that they are very expensive and sometimes they are dangerous.