F-Troo

Air Detective Tip 16

For Aircraft Accident Investigation

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**Tip 16: Aircraft Instrument Analysis**

In regards to modern CFAR Part 121 airliners and corporate aircraft it is flight data recorder systems that yield the best information on instrumentation. Collection of post-crash instrument readings, if they survive, only tells what happened at the time of impact. However, in smaller general aviation and older non-commercial aircraft, inspection of the cockpit and associated instruments and systems may provide valuable and corroborating evidence to the accident profile. In either category of aircraft, inspection and documentation of all surviving cockpit environments is critical to understanding the entire accident picture.

Obtaining pre-impact information from cockpit instruments is helpful, but not always reliable. Impact damage and fire often destroy whatever instrument evidence may have existed. Nevertheless, the documenting of all instruments and switch positions is a critical aspect of the investigation. This is a starting point in the process of evidence that may corroborate another observation.

Switch and control settings should be recorded and then the cable, linkage, and actuators should be checked to ascertain the continuity. This becomes important in the investigation of trim servo runaways and other possible non-commanded control movements. Remember, the switch and control environment may have been disturbed during the rescue and recovery operations or by impact forces, thus the need for looking "downstream" at the other hardware.

Instruments should be checked for crush angles on the containers and position of internal mechanisms. Gyros and other geared or gimbaled instruments may show metal binding points that reveal last point positions. Caution is in order. Do not rely on these readings to ascertain the altitude or profile of the aircraft! Instruments may reveal what happened at impact, but not through the evolution of the flight. Remember; corroborate every observation with another source. This was referred to earlier as the "Picture Frame Process." The investigator should ask, "Do these instrument readings dovetail with other evidence?” Having a photo of a similar cockpit will assist in figuring out the cockpit switch positions, etc.

Face readings of instruments are dubious at best. However, using black light, shadowing and close-up inspections may reveal a "witness mark" as to needle's last or impact position. Without additional corroboration, this information is only an observation and no conclusion should be stated as to aircraft profile. Detailed analysis of any instrument should not be completed in the field. Here again the expert resources of the manufacturer or expert lab are in order.

Glass cockpits make instrument analysis nearly useless. There is a possibility that some instruments may store information in a memory card or other retrievable source. However, such recovery of data is tenuous at best. Though glass cockpits are associated with aircraft that also carry Flight Data Recorders (FDR), more small general aviation (non-commercial) aircraft now have glass panels but no recorders. Though not as comprehensive as the large air carrier flight data recorders, these small devices are becoming available for planes, cars, and other vehicles.

There are a couple of other items to check regarding flight profile information. Do not overlook any recording device, such as camera or video players. Some GPS systems, handheld or in-panel may have programmed information that, if recovered, may provide insight. Again, the investigator should be procedural in these efforts, but not overly optimistic.

Lab analysis of instruments and the internal systems should be a must to corroborate any visual evidence. Remember, the Pitot-Static systems must also be checked from the external ports through the lines and hoses leading to the instruments or air data computer.

As always, the investigator should exercise caution when searching the cockpits regarding biohazards of body tissues and fluids that may be present in the wreckage. Consider such areas a HAZ-MAT situation.