Day One of an Airplane Crash: Collecting and Preserving Evidence

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Aviation Law Seminar

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April 19th, 2011

To the average person, an airplane crash is simply that – something goes wrong causing a large chunk of metal, carrying precious lives, to catapult through the air and come crashing down. The media will then pick up the piece and let the world know of any survivors, their theories on why the plane crashed, and then they move on to the next story. An airplane crash investigation, however, is not like a CSI episode that wraps up in an hour; it is a detailed process that may take up to weeks, months, and possibly years. This paper, however, is simply concerned with the first 24 hours after an airplane has crashed. These first 24 hours prove the most vital in ensuring that all evidence is collected and preserved so that experienced detectives and scientists can determine the cause of the plane crash.

A. Understanding *Daubert* is essential to admitting evidence that has been properly collected and preserved

1. *Daubert* Test restricts what evidence an expert may testify to in court

In *Daubert v. Merrell Dow Pharmaceuticals, Inc,*[1] the Supreme Court dealt with the admission of scientific evidence and the search for the truth through numerous controversies in an efficient and timely manner. For years, there has been this struggle between law and science in allowing jurors the opportunity to hear scientific evidence.[2] Except an issue arises when an attorney attempts to enter scientific evidence, only to have that evidence denied admissibility.[3] Therefore, it is essential to understand how scientific evidence can be introduced into court – through this understanding, investigators can then properly collect and preserve evidence ensuring that they follow guidelines that will hopefully ensure admissibility in court. To understand how *Daubert* was formulated, one must consider the initial standard for admission of scientific evidence set in *Frye v. United States.* In *Frye*, the standard allowed for both opposing counsels to present their own experts and essentially, pit them against each other. These experts would testify for their respective side and claim that the evidence in question is generally

accepted and therefore admissible.[4] Opposing counsel's expert would then argue that the evidence in question is not generally accepted, and thereby allow the jury to decide which expert seemed correct. Though this theory seems appropriate in principal, the court finally realized several problems. Critics noted that *Frye* hadn't established much of a standard. They said this standard created an expensive "battle of the experts" where overpaid experts from each side faced off and attempted to convince a jury with overwhelming amounts of information.[5]

Then in 1993, the court replaced the *Frye* test with the *Daubert* test that was based off of Federal Rules of Evidence 702 and 104(a). Federal Rule of Evidence 702 says, "if scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise." The Court also referenced Federal Rule of Evidence 104(a) which states that the trial courts must initially determine whether an expert wants to testify to "(1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue."[6] The Court then based the *Daubert* test from these two rules and created a two-prong test. These two prongs are: (1) reliability and (2) relevance.

For the first prong, the *Daubert* Court established a list of "suggested factors" to the trial court consider in finding reliability. These factors include: (1) does the methodology test the technique or theory to see if they can be falsified; (2) has the technique been published and peer-reviewed; (3) what is the rate of error of the methodology; (4) has the technique or theory been generally accepted in the relevant scientific community. [7] The Court, however, did state that this list is not exhaustive – instead, if the evidence was "good science", it would be allowed into evidence, whereas it might not have been under other rules. The question then becomes what

factors are used to determine reliability and who decides what is "good science" and what isn't? This question was effectively answered under the second prong of the *Daubert* test: relevance.[8] This prong essentially required judges to act as "gatekeepers" of scientific expert testimony and decide whether that expert's method is good enough to be presented to the trier of fact. This puts quite a bit of pressure on the judge. However, in creating this responsibility, the jury will then only hear testimony on evidence that has been collected and preserved under proper protocols. They jury is also assured that the testimony they hear is based on the expert's acceptable methods of, in this case, collecting and preserving the evidence. Then, the jury need only focus on the testimony they are hearing, and not whether the expert pulled a CSI move and managed to collect all the evidence within a manner of minutes.

2. *Daubert's* underlying policy ensures that junk science is eliminated and real science is admissible in court

With *Daubert* taking over as precedent for allowing scientific evidence, a question arises as to what *Daubert* really does. Simply put, *Daubert* ensures that "junk science" is eliminated from the courtroom and "mainstream" science becomes admissible.[9] Junk science can be identified by several measures. It is usually based on erroneous notions – a belief system that can't be put to any scientific test, like Freudian psychology for example.[10] In *Jacobellis v. Ohio*, a case involving pornography, Supreme Court Justice Stewart Potter said that junk science can be recognized when he said "I shall not today attempt further to define the kinds of material I understand to be [pornography], … but I know it when I see it."[11] As opposed to real science, junk science is dogmatic in that it supposedly validates itself without reference to higher authority. With *Daubert*, the court serves as a gatekeeper of good science, preventing testimony and evidence that is "questionable from a methodological viewpoint" or evidence that is irrelevant from being admissible. Conversely, *Daubert* makes no mention of "junk science"

within its four factors.[12] The Fifth Circuit noted in *United States v. Katz* that, in preventing the admissibility of junk science, it is troubling that so many judicial resources are allocated to these *Daubert* hearings.[13] However, *Daubert* provides a standard to ensure that only the best and most reliable evidence is admissible in court. *Daubert*, then, allows investigators to collect and preserve evidence based on strict protocol to ensure that a thorough investigation and case are brought to trial.

B. Collecting and preserving evidence within 24 hours allows for accurate and uncontaminated results

1. Management of an airplane crash creates order and a chain of command

As in any other accident, the scene of impact is just as important to air accident investigators as is the crime scene to police investigators.[14] The scene of impact is essential for four reasons: 1) the scene of impact may be a contributing factor to the cause of the accident when the accident is a ground accident, 2) the scene of impact is the place the "as found wreckage" came to rest, 3) the scene of impact is a factor in what law must be applied, and 4) much of the private investigation must be performed within that forum's accepted practice and legal framework.[15] A scenario where an airplane has crashed on an airport will be used to facilitate an understanding of how an airplane crash investigation is conducted and how evidence is collected and preserved within the first 24 hours.

Before discussing exactly how evidence is collected and preserved, it is important to understand who oversees the investigation and how order is maintained. To a lay person, the scene of impact can be a horrific sight of twisted metal and bodies, most of which are unrecognizable.[16] For seasoned investigators, the scene of impact is simply the beginning of a long and methodical investigation. As soon as an airplane crashed, first responders arrive. These first responders are the airport police or Port Authority police closely followed by the airport

crash fire truck and EMS. Often times, a bystander witnesses the crash and immediately calls 911. In case a bystander doesn't see the plane crash, the Federal Aviation Administration (FAA) will find out about the loss of an airplane because someone's family member didn't arrive or an air tower saw the plane crash.[17] Typically 911 gets a call, the call is routed to the flight service district office (FSDO) who then sends out a representative. Once EMS and the police arrive on scene, the airport begins its emergency plan. The first step of a five-step plan is to attempt to rescue survivors, if any.[18] Airport personnel have a right and a duty to save lives. The second step is to handle any situation to ensure that the airplane is safe, or rather, no longer in danger. This is a minimal allowance step – it only allows for personnel to preserve the airplane. Tasks to preserve the airplane include pouring out raw fuel, turning-off appropriate switches, fighting fires, etc. Basically, this step doesn't allow personnel to take actions that they don't necessarily have to. [19] Once this step is complete, personnel take prophylactic measures in securing the scene and making sure it is safe for investigators.

The fourth step, then, is to preserve the wreckage as potential evidence, which will be discussed in the next section. However, it is important to note the parties that are then allowed near the wreckage. Aside from essential EMS and airport personnel, the FBI may show up if they were following a lead on a person due to homeland security issues. However, 9 times out of 10, an FBI agent will not show up. This leaves the FSDO representative who is in charge of protecting the evidence. The FSDO representative isn't allowed to touch or move anything – he is simply there to protect the evidence and wait for the investigator in charge (IIC) to arrive. The IIC will be a member of the National Transportation Safety Board (NTSB). [20] Once a NTSB member arrives, NTSB effectively takes over the investigation of the claim, hires experts, collects evidence, and takes possession of the wreckage. It is also noteworthy that the NTSB

member then will invite the manufacturer's representative, for example, a CESSNA investigator, as well as the owner, the engine manufacturer, as well as the manufacturer of any component part that might be implicated in the crash to participate in the investigation. The only party not invited to the investigation is a representative of the passengers – they are typically not a part of the formal investigation. [21] And finally, the fifth step requires that personnel restore the airport and runways to routine use.[22] This ensures that extra personnel and civilians aren't milling around the scene of impact, and it provides for some normalcy during the investigation. Once the scene has been controlled and managed, the ICC controls the investigation and begins delegating tasks and ensuring that a thorough investigation is performed. After this five-step process, the ICC is ready to begin proper collection and preservation of evidence.

2. Protocols for collecting and preserving evidence create a uniform method for all airplane crashes

As previously mentioned, it is crucial that a five-step plan occur to conduct a proper investigation. However, the section above focused on management and then provided a cursory overview of how the scene of impact is secured. For the proper collection and preservation of evidence, proper accident scene protocol must be thoroughly discussed. Once an airplane crashes, the scene of impact becomes the accident scene. This accident scene can be broken down into two categories: the macroscopic scene and the microscopic scene.[23] In this case, the macroscopic scene would refer to the airplane wreckage itself and its surrounding areas. The microscopic scene would deal with the trace evidence found inside the plane, chemicals, etc. Aviation crash investigation is not a mechanical process; rather, it is a dynamic process that necessitates an active approach by the IIC who must be aware of the linkage principle of the evidence, and use scene analysis and definition techniques.[24] Proper investigations are based on the Locard Exchange Principle, which states that "with contact between two items, there will be

an exchange."[25] Through this principle, a four-step process was designed for accident investigations: recognition, identification, individualization, and reconstruction. Recognition deals with surveying the scene, documentation, and the collection and preservation of evidence (this paper's focus). Identification is when the evidence is taken back to a lab and comparison testing is performed. Individualization occurs when evaluation and interpretation of the evidence takes place followed by reconstruction, which involves reporting and presenting conclusions.[26]

Recognition is probably the single most important step of the four-step investigative process. This step begins as soon as the first responders arrive on scene. Here, it was noted that airport personnel and EMS may be the first to arrive. Their duties are vital in that they are the only people who view the accident scene in its original condition.[27] Upon arriving, first responders are responsible for checking for any survivors in the plane crash, detaining any witnesses and separating them to maintain their objectivity. The first responders must then protect the accident scene – typically, a two-tier barrier tape is created. The first tier is looped around the wreckage to ensure that no one contaminates the scene. The second tier is looped outside the first tier – this tier is usually used to keep onlookers out, as well as reporters, witnesses, uninvited officials, etc. First responders will later be called upon to communicate to investigators as to any alterations they've made to the scene. [28] Once the scene is secured, an officer shall be designated as the scene security officer to prevent entrance into the crime scene. He will maintain a contamination log (security log) to record all entries and exits to and from secure areas. [29] Once the IIC arrives, he will conduct a preliminary scene survey or "walk-through" along with the first responder. This survey has several guidelines in place. The IIC should use the walk-through to mentally prepare a reconstruction theory that will be altered as the scene investigation progresses. The investigator will then note any temporary or conditional

(result of an action) evidence that requires immediate protection or processing.[30] This is usually done through meticulous documentation, accident scene photos (real-time), and scene sketches. The air accident investigator will note the positions of any major sections of the aircraft, such as engines, control surfaces, landing gear, and so on. If a piece is not anywhere near the plane, this may indicate that the piece became detached before the crash, and its absence may have contributed to the crash.[31] The IIC should also note changing weather conditions that may alter the state of the wreckage. A possible thunderstorm could wash away crucial evidence and therefore, the investigator is responsible for keeping up with weather changes in the area. Then, the investigator will record initial observations of who, what, where, when, and how. And finally, the investigator will assess the scene for personnel, precautions, or equipment that will be needed and notify superior officers or other agencies as required.[32]

After completing all the accident scene documentation, the investigator will begin an intensive search of the scene for physical evidence. This is a very methodical process in that this evidence is the crux of the case – it will help establish why the plane crashed in the first place. An experienced IIC will be able to recognize and adapt the search method that best suits the situation or scene.[33] Air crash investigators work to a routine summarized by the mnemonic TESTED: the tips of the wings and tail surfaces; the engines; the primary and secondary control surface; the entire tail assembly; the external devices such as the landing gear and wingtip fuel tanks; and the doors which also includes hatches, canopies, and windshields.[34] If any of these pieces are missing, they are indicators as to the type of failure that caused the airplane to crash. TESTED thereby also begins the collection and preservation of physical evidence once an intensive search of the scene is complete. The IIC will, or may designate one person, to collect the evidence under the title "evidence collector." This includes collecting, packaging, marking,

sealing, and preserving all the evidence in a consistent manner – no item of evidence will at any point be misplaced, lost, or contaminated if only one person is obligated to carry out this process.[35] In collecting the evidence, there isn't a "set" way to collect the evidence per say. Yet, some types of evidence, by their nature, are given priority of order.[36] Evidence that is transient, fragile, or easily lost should be collected first. Air accident investigators are luckier than their crime scene equivalents in that a criminal may do everything to cover his tracks. Operators of airplanes, however, are constantly required to input data on their flight, communicate with ground towers, and keep all equipment functioning.[37] These simple tasks mean that when investigators arrive on scene, they have quite a bit of equipment to collect and preserve that will later reveal extensive data about the flight.

Before collecting evidence on the plane, an investigator should begin his evidence log by contacting the ground tower and collecting any air traffic control (ATC) tapes. ATC tapes are recordings of any contact between the aircraft and a ground controlling station.[38] These tapes must be collected immediately before the tapes are erased or reused. Under Federal Rule of Evidence 1002, this tape serves as the best evidence for the conversations that occurred between the aircraft pilots and ground control.[39] These tapes are marked with universal time marks so that they may be precisely coordinated with radar and any other tapes collected as evidence. [40] Additionally, these tapes can later be processed for sound analysis, voice recognition, and interpretation. Once these tapes are collected, the investigator should begin the actual collection of the evidence on the plane.

Since the investigator will be collecting mostly various pieces of equipment that store data, he must take several measures to preserve the evidence. For electronic devices that store retrievable data, the investigator should not touch the device unless he is familiar with and

understands the system.[41] If he does not, he should call in an expert to assist with the collection. If the investigator knows how to handle the system, he should remove the components quickly and carefully by cutting wiring in a way that keeps connectors intact where possible. The investigator should then protect components from hostile environmental conditions.[42] To protect components from hostile environments, the evidence should be collected and preserved in a consistent and careful fashion. The investigator is initially advised to place all items of evidence in a primary container that is then placed in a secondary container.[43] Because most of the evidence collected will be electronic equipment, the first container should be composed of special static electricity free electric insulator bags, or some static free material. As mentioned previously, since wires are cut to remove the equipment, these wires and connector ends should be covered with static free wrappers as well. [44] This step is performed to ensure proper data retrieval and protect any evidence that is found in the equipment. The secondary container is more of protective cover for the primary container. The secondary container can be things like envelopes, packets, canisters, paper bags, plastic bags, etc. However, because this equipment is so sensitive, it is highly advised that the secondary container be water-resistant.[45] Once the equipment is wrapped in its primary container and then placed in a secondary container, the secondary container should be sealed off with tamper-resistant tape. The secondary container (also known as the outer container) should then be marked with information about the items contained, identification of the collector, date, time, and location of collection of the item (in this case, location of the airplane).[46] The sealing tape should completely cover any openings on the secondary container and should be marked with the initials of the collector and the date and time of collection. This double container method will apply to all the equipment collected throughout the first 24 hours.

The IIC will be faced with the bodies of the passengers, pilots, and crew. This evidence is the most fragile and probably the most overwhelming. Therefore, as a rule, the bodies are quickly photographed, tagged, and the location of the bodies charted to respect to the airplane.[47] Because the human body enters rigor mortis (stiffness) after approximately 15 minutes, and the human body temperature drops approximately 1.5 degrees Fahrenheit per hour, the IIC must quickly arrange to collect and preserve the bodies.[48] A sealed body bag (typically water-resistant) is ideal for the removal of the body because in case the body is not whole, each body bag can contain all the body parts they may have fragmented, some of which might be crucial for identification.[49] Aside from identification, the idea behind collecting each passenger in a body bag is to determine overall data. Typically, in plane crash with many passengers, the pattern of injuries in the passengers is often either uniform or has a steady logical gradation of injury.[50] A change or deviation from these patterns can show investigators that either different parts of the airplane were subjected to varying stresses, or that there might have been some sort of explosion. An in-flight explosion can be determined from the initial photographs the IIC takes. These photographs may reflect lesions on a body's surface or a foreign material that has embedded itself in the body.[51] The IIC is under no circumstance allowed to remove or touch any evidence on the body itself. This could cause severe cross-contamination. The idea is to ensure that each body is collected with, if any, other body parts surrounding it and placed in a single body bag and is tagged with some sort of identifier. Identifiers can be numbers that the IIC creates and then notes on a grid pattern of where he located each body.[52]

One of the most important aspects in the investigation of an airplane crash is toxicological analysis of the pilot's bodily fluids and/or organs. If possible, the pilot and, if there was one, the co-pilot's bodies should be sent for autopsy immediately. The medical examiner

should then collect biological samples including blood, urine, vitreous fluid (from the eye), spinal fluid, bile, gastric contents, liver, muscle, spleen, lung, kidney, brain, and heart tissue. These samples are collected in prepackaged boxes containing test tubes (vacutainers), specimen bags, syringes, and needles. This type of box is called a TOXBOX and is available, in advance, to medical examiner departments in the case of an airplane crash. Once these samples are collected, they are sent to the Federal Aviation Administration's Civil Aerospace Medical Institute for analysis.[53] Because the body will quickly begin to decompose, the IIC must make sure the pilots' bodies are bagged, tagged, autopsied, and that these samples are sent off to analysis within the first 24 hours after a plane has crashed. For example, if the pilot had an alcoholic drink and dies in the crash without survivors, no one may know what the pilot consumed. Plus, under the alcohol burn-off theory, the human body metabolizes 1/3rd ounce of pure ethyl alcohol per hour, which makes each hour precious in determining if the plane crashed due to pilot error.[54]

As soon as the bodies have all been collected and tagged, the investigator can then move on to either examining the plane under the mnemonic TESTED, or he can begin collecting personal items on the plane. For the sake of understanding and continuity, it is assumed that the IIC begins to collect personal items. This may seem tedious and pointless, but the smallest piece of evidence could yield a clue as to why the plane crashed. Using the example previously illustrated of a pilot having an alcoholic drink, the IIC will search the cockpit for any identifiable containers that may contain liquid or food that the pilots may have digested before or during the flight. Personal items for the pilots could include any bags they had in the cockpit, music players (IPods, MP3s, etc), reading material (books, magazines, etc), and any other possible distractions.[55] Collecting these items proves a dual purpose. First, investigators can use them to

determine whether pilot error played a factor in the airplane crash. Perhaps a music player was too loud or the pilots were discussing some article in a magazine. The second purpose is that any of these items could contain trace evidence. Whether it be soot from a fire, charring from an electrical spark, or some fluid that may have damaged the controls, each piece must be collected in a separate container to prevent cross-examination. If any items appear wet or moist in nature, they must be temporarily packaged in nonairtight containers. It should then be allowed to air dry in a controlled environment and be repackaged with the original containers in new nonairtight containers. This is mostly to prevent bacterial growth or degradation of the evidence.[56] Once all personal items have been collected in the cockpit, the investigator will then collect any other personal items found in and around the airplane. This includes luggage, clothing, reading materials, electronics, etc. The theory behind collecting evidence belonging to the passengers and crew members is to help understand why the crash occurred in the first place.[57] Items such as cell phones, PDAs and computers can provide evidence of perhaps a conversation a passenger had with a family member before the crash occurred. A computer could depict a message a passenger left when he realized something was wrong with the plane, and so on. Also, since these items are composed of various metals and plastics, they can help determine whether a fire occurred during the flight since they would most likely begin to melt before the plane crashes. This is contrasted to a plane that crashed and then a fire smolders and begins to burn the contents of the plane.[58] If a plane was on fire in mid-air and the point of origin was in the middle of the plane, personal items in the middle of the plane would be in a significantly worse condition than those in other parts of the plane. However, if the fire began after the plane crashed, personal items near that point of origin will most likely be the only items with any charring or soot on their surfaces.[59]

Along the lines of the above example, the IIC may have to deal with fire evidence before examining the airplane itself. Fire evidence is almost inevitable since most airplanes crash onto some sort of surface that creates a fire. If the plane landed in the water, the fuel may still cause parts of the airplane to explode. Airplanes are inherently susceptible to a high fire and explosion risk potential because they contain large amounts of flammable liquids including gas, hydraulic fluid, oils, and solid combustibles.[60] In this case, the hypothetical airplane crashed on a runway, and a fire is almost always expected. Although the degree of damage caused by the fire or explosion is unpredictable, it is known that such damage will cause thermal and pressure damage, generation of heat, smoke, and toxic by-products.[61] Searching a fire scene is time-sensitive since the investigation and collection of evidence begins as soon as the fire has been extinguished.[62] A fire scene is time-sensitive mostly because fire evidence can begin to evaporate or dissipate within a matter of hours.[63] A search of the fire scene must focus on finding the fire's origin. Generally, there aren't any hard and fast rules in identifying the fire's origin but normally, a fire has a tendency to move in an upward direction. Therefore, the probable origin will most likely be located closest to the lowest spot that shows the most intense characteristics of burning.[64] If there was only a fire after the plane crashed, then the point of origin may be relatively easy to determine. However, if a fire or explosion occurred while the plane was in-flight, factors such as the speed of the airplane, cabin air pressure, and other factors may affect the location of the point of origin. It is also important to note that the point of origin may be obliterated by residual fire damage.[65] Therefore, it is imperative that, once located, the point of origin be protected as necessary to permit careful investigation. This includes sketching the area, photographing it extensively and if the point of origin is exposed to weather conditions or other damaging conditions, it should be covered or secured by some sort of water-resistant canvas.[66]

The next most common accidental ignition source is mechanical failure, such as those from catalytic converters. An airplane can contain an Ozone/VOC catalyst, used in airplane cabins, that helps maintain a healthy cabin environment and provide improved comfort for passengers, pilots, and flight attendants.[67] The most condensed compartment of potential fire origin is the engine compartment, which contain fluids and electrical and mechanical components in one or more small, combined areas (depending on the size of the airplane).[68] As a matter of routine, two or three quarts of ash and soot debris must be collected at the point of origin of a fire. Also, any other porous materials and substances thought to contain flammable residues should be collected.[69] Typically, soot will only accumulate on relatively cool pieces and soot will most likely follow airflow patterns, which can help investigators determine the direction the fire was traveling, thereby confirming the point of origin as well.[70] These specimens should be immediately packaged into an airtight container so no loss of possible residue can occur through evaporation. A good container would be a new, clean paint can with friction lids because it is low cost, airtight, unbreakable, and is available in a variety of sizes.[71] The IIC may not be aware that accelerants present in soil and vegetation, areas like the strip of land between runways, can be rapidly degraded by bacterial action. A quick fix is to quickly collect the evidence and preserve it by freezing the samples containing soil or vegetation. This has been show to be an effective way to prevent this degradation.[72]

Once the investigator is at the scene of impact and ready to examine the airplane, he should begin by photographing and noting the evidence he is about to collect. He should also ensure that all items be packaged separately to prevent cross-contamination – in this case, an incident where two wirings could collide and perhaps cause data to be deleted.[73] Using the air accident investigation mnemonic TESTED, the investigator will begin by examining the tips of

the wings and tail surfaces. At the wings and tail surfaces, the investigator is looking for pieces that have fallen of, been scraped off, or possible gouges created by the landing gear.[74] Since these items are still solids, they can be easily collected, stored, and preserved in the same way the equipment was handled. These pieces probably won't need static free wrapping, but a non-contamination wrapping should be used. The pieces can then easily be placed into the secondary container, most often a paper bag or plastic bag if weather conditions indicate some sort of precipitation.[75]

The IIC will then move on to the engines – this step calls for an inquiry into both an examination of the port engine as well as the starboard engine and wingroot.[76] Because these parts are larger and heavier than most other pieces of evidence, the investigator should first photograph each part, and then if possible, disassemble or call in a crew to remove the engine(s) from the plane. A thorough inspection of the engines at a later point may lead to a finding that one or all of the engines were not functioning properly at the time. However, the engines need to be collected and preserved in the condition they were found. The engines can be collected in the same way the equipment was collected, although the secondary container will now include a large tarp and several feet of tamper-resistant tape.[77]

The investigator will then enter the plane and examine the primary and secondary control surfaces. The first thing the investigator should collect is the flight data recorder (FDR), also known as the accident data recorder (ADR). The FDR is commonly known as the "black box." A FDR is an electronic device used to record any instructions that are sent to any electronic systems on an aircraft. Basically, the "black box" records specific aircraft performance parameters. This item is essential in that it can provide data that can explain anything from how fast the airplane was going, to whether a certain performance parameter was off.[78] As per

collection and preservation protocols, the FDR and its wirings should be wrapped in static free wrapping and then secured in a water-resistant bag, as should all evidence to follow. The investigator should then collect the cockpit voice recorders (CVRs). CVRs are recording devices that pickup all sounds, voices, and other noises in the cockpit – these sounds are recorded on reusable one-half-hour steel tapes that typically survive the crash.[79] This tape is also known as the second "black box" – unlike the FDR, this tape is returned to the aircraft owner after the investigation. This means that under Federal Rule of Evidence 1002, the tape is not the best evidence since a transcript is made to document the sounds. It is advised that the ICC request that the government maintain a copy of the tape and that the owner protect the returned original so as to not tamper or spoil the evidence.[80] Depending on the type of airplane, there may be additional data recording devices inside the cockpit – any and all of these devices should be collected in the same manner. In collecting these devices, it is imperative that the IIC document the area with as many pictures as possible. Pictures of anything within the pilot's reach can be at tell-tale sign of whether the plane crashed because of pilot error or simply a malfunction. Pictures of the interior of the cockpit can show which switches were on/off at the time of the crash. Also, pictures can show whether there were items in the cockpit that shouldn't have been there in the first place; for example, the pilot may have left a cell phone on that interfered with the plane's transmission signals.[81]

Since the ICC is following the air accident investigation mnemonic TESTED, he is now ready to inspect the external devices such as the landing gear and wingtip fuel tanks; and then doors which also includes hatches, canopies, and windshields.[82] After photographing the above listed parts, the investigator must take careful measures to take a sample of the fuel immediately and place it in a safe and secure container. Because fuel is a liquid and is quite volatile, it should

be placed in an airtight, unbreakable container.[83] Investigators may later want to determine what the exact composition of the fuel was at the time the airplane crashed and this sample may be the only solid indicator. If there are pieces of the landing gear strewn around the wreckage, they should be immediately collected in the two layer containers previously mentioned. The last step for an IIC is to examine the doors, hatches, canopies, and windshields. These parts should be photographed to see if any latches were rusted, broken, or not functioning properly. The windshields should be photographed for any possible cracks or liquids on the surface.[84] If any liquids are found on any of these parts, they can be collected like the fuel if there is enough liquid. If the liquid is minimal, a Q-tip is used to wipe some of the substance and then the Q-tip is placed in a sealed test tube for forensic analysis.[85]

Once all the evidence is collected, properly wrapped and preserved, the IIC should then personally deliver or under a chain of evidence assign an individual to deliver all collected evidence to an environmental laboratory for safe storage and future analysis. This building should be both water-resistant, fire-resistant, and should be kept at a cool temperature to prevent any damage to the evidence. If the storage facility gets too warm, it may melt the equipment, or create moisture that would cause the equipment to malfunction and consequently, fail to output data information during analysis.[86]

C. Proper collection and preservation of evidence the first day leads to a thorough investigation

Because most airplane crash investigations typically take up to a year, it is absolutely vital that all the evidence at the scene of impact be properly collected and preserved. The first 24 hours are the most vital since most evidence begins to degrade or decompose one way or another. The human body, as mentioned, begins to stiffen within 15 minutes and the liquids inside the body will begin to seep out as well. In the case of a fire scene, soot will collect on cool

objects, but it too will begin to evaporate within a few hours. It may take days to collect the proper evidence from the scene of impact but the first 24 hours mainly call for the collection of the evidence that can be lost, mishandled, begin to degrade or decompose. Aside from ensuring that the evidence is preserved as quickly as possible and stored for further analysis, the first 24 hours also call for the proper collection and preservation of evidence. An IIC may arrive in record speed to the scene of impact, setup a two-tier perimeter, begin an evidence log and chain of custody log and follow all initial protocols by the book. Then, the investigator begins the investigation without wearing a pair of gloves and without a camera. After spending 24 hours at the scene, the investigator goes home believing he's done a superior job in conducting a thorough investigation – except, he hasn't. This is much like the *State v. Jascalevich* case. The trial judge in that case allowed for rather novel scientific test procedures for a certain drug to be permitted over proper testing procedures.[87] Under *Daubert*, it has been established that certain steps must be followed to allow evidence into court – certain evidence may be incredibly important because it weighs on why the plane crashed, but if it is inadmissible, then it is worthless in the eyes of the court. [88] Coupled with Federal Rule of Evidence 1002, all evidence collected should be in its original form if possible if it is introduced to prove its contents. As mentioned with FDRs and CVRs, these tapes are highly valued for their content. A tape can tell whether a pilot was speaking with inflection or was simply communicating with his copilot. In the case of these tapes, if the IIC simply gets a transcript from the tapes, the transcript may not be admissible because it is not the original; if it is admissible, the jury will never hear the inflections or lack of inflection and therefore may weigh the evidence improperly.[89]

The NTSB carries a great responsibility when it begins an investigation and assigns an IIC. The fate of the investigation depends on how well the IIC collects and preserves the

evidence initially and then carries out the rest of the investigation. However, the collection and preservation of evidence is the foundation of any case.

If evidence is not properly collected in two-layer containers, if it isn't separated in different containers to prevent cross-examination, and if it isn't noted on an evidence log and stored properly, the evidence will not be admissible in court and the NTSB will be under fire for improperly conducting an investigation. An airplane crash differs from most other incidents because, in the case presented, numerous lives are lost and those families cannot rest without understanding why they lost their loved ones. It is therefore the IIC's job to ensure that he has done everything possible to determine the cause of the crash. And that all begins with the first 24 hours. By following these simple protocols and documenting and photographing evidence at each step, the IIC can most likely rest assured that he has performed his duty properly and that a thorough investigation can now continue because the IIC has begun the process in a concise and methodical fashion.

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[4] Slack (Scientific): 302.

[5] Slack (Scientific): 302.

[6] *Daubert*, 509 U.S. at 592.

[7] Id. at 592-594.

[8] Id.

[9] Slack (Scientific): 304.

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[41] McCormick: 150.

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[43] James: 178.

[44] McCormick: 149.

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[55] James: 170.

[56] James: 179.

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[58] James: 492.

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[63] Saferstein: 303.

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[65] McCormick: 159.

[66] Saferstein: 305.

[67] James: 496.

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[70] McCormick: 159.

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