Chapter 3
Pieces of the Puzzle: FBI Evidence Response Team Approaches to Scenes with Commingled Evidence

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Introduction

Since the establishment of the Federal Bureau of Investigation's (FBI's) Evidence Response Team (ERT) Unit in 1993, ERTs across the United States have been involved in the collection of evidence from scenes large and small. One hundred forty-one teams, composed of more than 1,100 members, have been formed within the 56 FBI Field Offices, or Divisions. Single or combined teams, in either Federal cases or as requested assistance in State or local investigations, have participated in over 2,000 crime or search scenes. FBI ERTs have been deployed internationally to sites in Africa, the Middle East, the Balkans, Central Asia, and Southeast Asia. Those domestic and international deployments have included bombings, terrestrial crashes, and mass graves in which the remains of the victims are intrinsically commingled. Regardless of the size of the scenes, similar fundamental approaches toward scene management and evidence collection have proven imperative in making sense of sometimes confusing situations.

Perhaps there is no other crime scene setting where the documentation of the three-dimensional position of fragmented and commingled evidence is more critical than that involving multiple or mass deaths. Such scenes may consist of the burial of two or more homicide victims in a common grave; or they could entail extremely fragmented remains over several acres of a crash scene. In both types of scenes, the identification of individual pieces in their environmental contexts preserves the patterns and relationships between evidence. These relationships, and patterns formed, are defined during the final stages of actions, which were physically or behaviorally controlled. The act, or reason for the final position of the evidence or remains, is initially controlled by human behavior and/or natural laws. Both controls have been the subject of a myriad of research. For example, the positioning of victims' bodies is many times the result of conscious or subconscious efforts of the killer(s). Brooks (1985), Burgess and Ressler (1985), Douglas et al. (1986), Douglas and Munn (1992a, b), Keppel (2005), Lundrigan and Canter (2001), Rajs et al. (1998), Ressler et al. (1985), and Rossi (1982) are just a representative few of the studies addressing the psychology behind victim selection, crime scene selection, and victim treatment that are ultimately reflected in the positioning of a body and other evidence. In cases involving clandestine burials, suspects

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go beyond affecting site selection and victim body position to also create and affect the space in which the body(ies) is(are) concealed. Hochrein (1997, 2002) discusses spatial evidence, or geotaphonomic characteristics, which are created and influenced by conscious and subconscious subject behavior. The physics behind the patterned distribution of evidence in explosive or collision events has been discussed by several authors, including Anker and Taylor (1989), Barrie and Hodson-Walker (1970), Bergen-Henengouwan (1973), Gable (1968), Hellerich and Pollak (1995), Hill (1989), Kreft (1970), Matteson (1974), Min and Jia (1992), Steele (1983), and Swegennis (1987), to, again, name a few. In postblast, or postcrash, settings, the controlling factor is, at some point, the physical dynamics of explosion, which involve known forces on known volumes and materials resulting in predictable patterns in which exploded materials are distributed. In the absence of explosion, forces of momentum will still affect evidence distributions. By precisely recording the final position of crash debris and human remains, as well as environmental features that could have affected their flight on the way to those positions, research and predictive models represented by the aforementioned references are possible or confirmed. In the same vein, the precise mapping of body position and associated evidence in a multiple-victim interment may reveal the human behavior that affected when, why, and how each individual was placed in the common burial. Often, however, crime scene investigators are faced with pressure from superiors or co-workers who believe the piece-plotting of evidence is pointless because they believe fragmentation occurs randomly, or all evidence in a clandestine grave was deposited contemporaneously. In order to overcome outside pressures to compromise during collection efforts, FBI ERT members receive training throughout their Bureau careers that emphasizes the efficient yet complete recovery of evidence. Regardless of the magnitude of the scene, the same efforts toward quality and quantity of information gathering are attempted.

In this chapter, the authors will present the FBI ERT concept and basic protocols. Two cases are then presented to illustrate how those protocols were followed and how the extra effort toward three-dimensional mapping of human remains and associated evidence can aid in the interpretation, reconstruction, and presentation of a crime or disaster scene. Both cases involve multiple victims and represent a middle ground between cases of a single victim and those constituting large-scale mass disasters.

FBI Evidence Response Team Protocols and Responsibilities

The quality and quantity of evidence collected at any crime scene are directly impacted by the amount of preparation by crime scene investigators toward potential responses. As mentioned above, FBI ERT members are required to apply fundamental techniques of crime scene management, evidence collection, and documentation to each and every site they process. In large and small scenes, personnel duties and responsibilities are clearly defined and basic stages involving the organization of the search for potential evidence are well known to all ERT

members. The size and magnitude of the crime scene may affect the number of personnel deployed to the scene, and the type of crime being investigated may require different forensic tools, but the basis for duties and assignments and organization of the search remain the same. The processing of a vehicle used in a crime may take only a handful of personnel to process. A major postblast, or -crash, scene could involve multiple teams from numerous field offices. For example, 137 ERT members were utilized toward the collection of evidence from the Pentagon crime scene in the aftermath of the September 11, 2001, terrorist attacks. In response to the events of that same day, 480 FBI ERT members worked over 10 months with other Federal, State, and local investigators in processing debris from the World Trade Center in New York City. At the same time 96 ERT team members were utilized at the crash of Flight 93 near Shanksville, Pennsylvania.

Certain personnel duties and responsibilities are necessary in almost any major search operation. The following duties and responsibilities are typically crucial to ensure that search efforts are conducted in an organized and methodical fashion. It is important to note it may not be feasible to have one person assigned to each duty. It is relatively common for one person to accomplish two or more. For all positions, the interest and attitude of personnel are paramount concerns. Training and experience will only be used to best potential when team members possess a positive attitude. This human side of evidence response teams is significant due to the long hours and attention to detail often required of personnel. The following lists the major assignments as well as corresponding general duties and responsibilities:

1. Team leader
2. Photographer and photographic log recorder
3. Sketch preparer
4. Evidence recorder/custodian
5. Evidence recovery personnel
6. Specialists (as required)

Team Leader

The team leader has the overall responsibility at the scene to ensure that communication, assessments, and responsibilities are conducted thoroughly and completely. The team leader assumes control upon arrival at the scene and is cognizant of safety issues that may affect team members. This may be as simple as having extra police officers or agents at the scene or may be as complex as prearranging military assets and personnel in a war-torn region. Once the scene is secured and any safety issues are addressed, the team leader, usually assisted by the photographer, will conduct a preliminary walkthrough of the scene with the purpose of evaluating potential evidence and preparing a written narrative. Once the scene has been evaluated, the team leader will brief other members of the team, will establish a search pattern, and will make appropriate assignments to team members. A command post should be created outside the crime scene. The command post could be located in a building,

under a pop-up tent, or inside a motor vehicle or could even be located under a shady tree. The purpose of the command post is to maintain a designated area where the exchange of information can take place between the team leader and investigative personnel. The command post is also the point where coordination between all law enforcement agencies occurs. The team leader maintains these responsibilities throughout the entire process and should continually reevaluate the efficiency of the search during the entire course of the operation. Once the search has been completed and a final survey and inventory review has been completed, it is the team leader's responsibility to release the scene.

Photographer and Photographic Log Recorder

The photographer should make every effort to document the scene before it is entered by other team members. This should include the photography of any victims, crowds, or motor vehicles that may be considered part of the scene. The photographer is required to photograph the entire scene with overall, medium, and close-up coverage, using measurement scales when appropriate. All items of evidence must be photographed before they are moved. This will require communication and cooperation between other team components to include the sketch preparer, evidence recorder/custodian, and evidence recovery personnel. Cooperation among these team components remains important when numbering and identifying items of evidence. Each item of evidence collected will have one number assigned to the item and should be identified using the same nomenclature on all logs created at the scene. Using a different description on logs can become confusing when testifying in court. A room described on a log as the family room and later described as a den on another log can lead one to wonder if there were actually two rooms. In the case of multiple skeletal remains, the confusion could be even greater. All latent fingerprints and other impression evidence are photographed with and without scale before any lifts and/or casts are removed. Every photograph must be documented by the photographic log recorder on a photo log, which should also include a photo sketch. The photo sketch depicts the item photographed and its relationship within the scene along with the angle and direction of the camera at the time of the photograph.

Sketch Preparer

The sketch preparer is responsible for determining the scope of the scene and the selection of equipment used for mapping. The sketch preparer determines if two-dimensional measurements are sufficient or if three-dimensional documentation is required. The sketch preparer determines if hand tools, total station, or three-dimensional scanning equipment is utilized. The availability of the equipment, the environment being mapped, and the type of presentation required in court will assist the sketch preparer in determining the suitable method. Regardless of the type of

sketch or equipment used, any prepared sketch must follow certain protocols and contain specific information. The sketch preparer must diagram the immediate scene and orient the sketch with north. Evidence item numbers and nomenclature must be coordinated with the other team components. Adjacent buildings, rooms, furniture, etc. need to be indicated as appropriate. The sketch preparer should obtain appropriate assistance for operating equipment such as total stations and three-dimensional scanners. It is very difficult for one person to operate this equipment, and training is necessary for all operators. Even simple measuring with hand tools is more efficient with assistance. The sketch preparer will determine the scale to be utilized. Whether the scene is depicted in feet and inches or it is determined that metric measurements will be used, measurements must be consistent and the sketch preparer must ensure consistency throughout the mapping process.

Evidence Recorder/Custodian

The evidence recorder/custodian is responsible for the overall coordination of the documentation, packaging, and preservation of all evidence obtained at the scene. The evidence recorder/custodian is responsible for maintaining an evidence recovery log, which reflects the description, date, times, location, and individual collecting of each item of evidence. The evidence recorder/custodian receives and records all evidence from the evidence recovery personnel and is responsible for coordinating numbering and nomenclature of items with all other components of the team. The evidence recorder/custodian maintains the chain of custody by maintaining control of the evidence from the scene to the transmittal of the evidence to the case investigator, property room, or crime lab, per agency guidelines.

Evidence Recovery Personnel

The evidence recovery personnel are responsible for locating and collecting items of evidence at the scene. They are also responsible for ensuring that each item collected has been photographed and placed in the sketch before it is moved from the scene and that the numbering and nomenclature of evidence are consistent with the other components. The evidence recovery personnel mark each item of evidence with their initials and date when collecting items. This is normally witnessed by a second individual who also initials and dates the item. This process ensures the availability of at least one evidence recovery member if testimony is later required at a court hearing or trial. The evidence recovery personnel are required to keep the team leader apprised of any significant evidence located throughout the search. The evidence recovery personnel ensure they are appropriately dressed (gloves, Tyvek, mask, etc.) to avoid any contamination issues while operating within the crime scene.

Specialists

It is sometimes necessary and prudent to bring in expertise from outside services. The field of forensic science is so broad today that no agency will have every form of specialty service available from among its ranks. Typically, specialists are brought in from industry, the academic community, private scientific laboratories, and similar concerns. The Evidence Response Team program has over 1,100 members nationwide, and several members have formal education in more than one listed specialty, but these individuals are not always available or in a specific geographic area where they can respond to every case. When dealing with outside specialists, some pertinent aspects to consider are

- The competency and reliability of the specialist
- The ability of the specialist to work within law enforcement guidelines at a scene
- The role of the specialist in presenting expert testimony in court

Specialists should be identified before they are needed in an actual case. A current contact list should be maintained if possible. The agency should meet with these individuals to determine the best manner to jointly conduct search planning, operations, and follow-up activity. Some examples of specialty assistance to be considered are described next.

Medical Examiner/Pathologist/Coroner

The medical examiner/pathologist/coroner role at a crime scene will vary by jurisdiction. Some states and counties are part of the coroner system. The coroner may or may not have a medical background and may have a staff to include pathologists or may contract out the work. It is important to be familiar with the system responsible for your crime scene. In some jurisdictions a pathologist will respond to the scene, in some jurisdictions the Medical Examiner's office will send one of its investigators, and in some jurisdictions there is no response to the scene. The important point to remember in all these scenarios is that the deceased is the responsibility of those medical examiner/pathologist/coroner jurisdictions and that the remains should not be touched without their approval. Regardless of which system is in place, the medical examiner/pathologist/coroner is responsible for the postmortem examination.

Odontologist

The odontologist can be very useful in the identification of the victim. The odontologist is capable of comparing ante- and postmortem dental records and rendering identification. The odontologist is extremely useful when dealing with skeletal and decomposed remains. The odontologist normally conducts these comparisons at the morgue or a dental office. The odontologist should be utilized at the scene of arson where burned teeth can be preserved before transport of the remains. The teeth of victims in post-arson scenes can be easily destroyed and lost during movement of the remains. The odontologist can preserve the teeth for transport and is able to

more easily identify burned teeth within the scene. Odontologists responded to the Tsunami disaster in Phuket, Thailand, and assisted in many of the identifications made there. Three acceptable methods of identification were accepted in Thailand for the Tsunami victims: dental, DNA, and fingerprint comparisons.

Anthropologist

The anthropologist can identify skeletal portions of human remains and, using the skeletal remains, can determine factors such as age, race, stature, and gender, which are very useful in the identification of the remains. The anthropologist can also assist in determining if skeletal remains are human or animal. In the case of mass or commingled graves, the anthropologist can sort the skeletal remains and group the remains by victim. Anthropologists can assist in identifying tool marks on bone and in determining whether they are caused by animals or weapons. They can assist in determining whether damage to the skeletal remains occurred ante-, peri- or post-mortem.

Entomologist

The entomologist is useful in the collection, preservation, and identification of various insects located within the general area of the human remains. The entomologist is able to assist in determining the time of death by studying the development of the collected specimens and determining the environmental conditions over a specified period of time.

Botanist

The botanist, like the entomologist, is able to assist in determining the time of death after collecting and identifying plant life found within the general area of human remains. The botanist also requires local environmental conditions to assist in the determination of time of death. The botanist can further assist in determining plant material associated with the remains that is not consistent with the area where the remains were recovered.

Blood Pattern Analyst

Using acceptable scientific methods, the blood pattern analyst is able to enter a bloody crime scene and analyze various groups and shapes of bloodstains. Through this analysis, identification of various types of stains, the velocity required to create the stain, and the direction of travel can be determined. The blood pattern analyst can assist the investigation by offering a recreation of the events and identifying types of instruments used to create the pattern.

Geologist

The geologist can assist the investigation with issues relating to rock and soil. During the recovery of human remains, the geologist can advise on the consistency of soil as the grave is excavated and identify any soil and/or rock that is not consistent with the local region. A geologist can be useful in determining data obtained through the use of ground-penetrating radar or other geophysical prospecting methods.

Surveyor

A surveyor or surveying crew is useful in mapping utilizing the total station. A surveyor can also assist in locating local maps and topographic maps.

Engineer

Engineers can be of assistance in cases such as postblast scenes where large structures have collapsed or partially collapsed. They have expertise in shoring, bracing, evaluating, and lifting structural components.

Bomb Technician

The bomb technician can be called to assist in cases where an explosive device is present or intelligence reports the possibility of such devices. The bomb technician can sweep the scene for primary and secondary devices. The bomb technician has render-safe capability and can conduct the render-safe technique at the site or transport the device to another location for detonation.

Crime Laboratory Examiner

The crime laboratory examiner is generally trained in several or one specific discipline such as DNA, trace evidence, firearms and toolmarks, chemistry, etc. Depending on the circumstances of the case and local policy, it may be advantageous to request a crime laboratory examiner to respond to the scene or to consult with the examiner over the telephone. The crime laboratory examiner can assist in providing information on the proper collecting, packaging, and transmittal of specific types of evidence.

Safety Officer

The safety officer is trained in the use of various detection devices to measure hazardous gases such as carbon monoxide and methane. The safety officer is also OSHA trained and can advise team members regarding the mandate to wear steel-toed shoes, helmets, protective eyewear, levels of Tyvek, etc. The safety officer receives training in confined space and, like the engineer, can assist in partial or full building collapses.

Hazmat Specialist

The Hazmat specialist is trained in the detection and mitigation of all hazardous materials, including chemical, biological, and nuclear materials. No suspected scene should be entered by personnel before it has been cleared by a Hazmat specialist. The Hazmat specialist is also trained in the collecting and shipping of evidence in a hazardous environment.

Organization of the crime scene search process is paramount to any successful search. The FBI Evidence Response Teams are trained in a basic 12-step process as described below:

1. Preparation: Preparation requires training and maintaining adequate supplies and equipment to conduct the crime scene search. Teams are required to accumulate packaging and collection materials necessary for typical search circumstances. A list of required supplies and equipment is maintained, and teams put together response kits for various type scenes such as Latents, recovery of human remains, DNA collection, etc. Each team member receives training in completing computerized and preformatted logs and administrative work sheets. Prior to the search, legal documents and ramifications are discussed among the team. This may involve reviewing the search warrant for familiarization of the items and types of items to be seized. The team leader is preselected, and assignments to other positions are generally predetermined. Specialized vehicles are stocked with supplies and equipment to handle a variety of circumstances to include communications, shelter, lighting, etc. Each team member is issued a variety of clothing to cover a wide range of weather conditions. Safety equipment such as steel-toed boots, gloves, helmets, eye protection, and respirators is issued to each team member. In the event of extended searches, a rotation of teams is developed. On several remote and overseas deployments, food and water were made part of the load-out package. Several teams maintain their own medically trained personnel or draw medical personnel from other entities within the FBI. Local medical resources and adequate hospitals are identified prior to all deployments. Prior to arrival at the scene, communication is usually established with services of an ancillary nature (e.g., medical examiner, prosecuting attorney, and other specialists as required) so that questions that surface during the investigation may be resolved.
2. Approach scene: Upon initial arrival at the scene, be alert for evidence and be cautious concerning transient evidence, foot/tire impressions, and trace evidence. Make certain to protect evidence if necessary from contamination or loss. Extensive notes should be taken immediately; the notes can be written or dictated. Consideration of the safety of all personnel is paramount.
3. Secure and protect: Take control of the scene immediately, and determine the extent to which the scene has been protected. Obtain information from personnel who have knowledge of the original condition of the scene, including first responders, medical personnel, any witnesses, and/or surviving victims. Designate one person in charge for final decision making and problem resolution. Take

extensive notes, and do not rely on memory. Keep out unauthorized personnel and record times and names of all personnel entering or leaving the scene.

4. Preliminary survey: Cautiously walk through the scene, and maintain administrative and emotional control. Select a narrative technique (written, audio, or video). Have preliminary photographs taken by the designated photographer. Delineate the extent of the search area, and initially expand the perimeter. Organize methods and procedures to be utilized, and recognize special problem areas. Identify, protect, and document transient physical evidence. Determine personnel and equipment needs, and make specific assignments. Develop a general theory of the crime based on current information. Take extensive notes to document the scene, and describe the physical and environmental conditions as well as personnel movements.
5. Evaluate physical evidence possibilities: This evaluation begins upon the arrival at the scene and becomes detailed in the preliminary survey stage. Ensure that the collection and packaging materials and equipment are sufficient. Focus first on evidence that could be lost and leave the least transient last. Ensure all personnel consider the variety of possible evidence, not only evidence within their specialties. Search the easily accessible areas and progress out to view locations, always being aware of hidden items. Evaluate whether evidence appears to have been moved inadvertently or whether the scene appears to be contrived.
6. Narrative: The narrative is a running, general-terms description of the condition of the crime scene. The narrative describes the scene in a "general to specific" reference scheme. Use a systematic approach in narrative. Nothing is insignificant to record if it catches one's attention. Under most circumstances, do not collect evidence during the narrative. Use photographs and sketches to supplement, not substitute, for the narrative. The narrative should include case identifier; date, time, and location; weather and lighting conditions; condition and position of evidence.
7. Photography: Photograph the crime scene as soon as possible and prepare a photographic log that records all photographs and a description and location of evidence. Establish a progression of overall, medium, and close-up views of the crime scene. Photograph from eye level to represent the normal view. Photograph the most fragile areas of the crime scene first. Photograph all stages of the crime scene investigation including discoveries before the evidenced is moved. Photograph the evidence in detail, and include a scale with the photographer's name and the date. When a scale is used, first take the photograph without the scale. Photograph the interior crime scene in an overlapping series using a normal lens, if possible. Overall photographs may be taken using a wide-angle lens. Photograph the exterior crime scene, establishing the location of the scene by a series of overall photographs including a landmark. Photographs should have 360 degrees of coverage. Consider aerial photography when possible. Photograph entrances and exits from the inside and the outside. Photograph important evidence twice, taking a medium-distance photograph that shows the evidence and its position to other evidence. The second photograph is a close-up photograph

that includes a scale and fills the frame. Prior to entering the scene, attempt to acquire prior photographs, blueprints, or maps of the scene.

8. Sketch: The sketch establishes a permanent record of items, conditions, and distance and size relationships. Sketches supplement the scene photographs and the narrative description. Sketch number designations should coordinate with the evidence log number designations. Sketches are normally not drawn to scale; however, the sketch should have measurements and details to complete a drawn-to-scale diagram if necessary. The sketch should include case identifier; date, time, and location; identity and assignments of personnel involved in the sketch; dimensions of the rooms, furniture, doors, and windows; distances between objects, persons, bodies, entrances, and exits; measurements showing the location of evidence; key, legend, compass orientation, scale, scale disclaimer, or a combination of these features.
9. Conduct crime scene search: Use a search pattern (grid, strip, or spiral) and search from the general to the specific for evidence. Be alert for all evidence, and carefully search entrances and exits. Wear latex or cotton gloves to avoid leaving fingerprints. To avoid contamination, do not excessively handle the evidence after recovery. Label and seal all evidence packages at the crime scene. Obtain known standards (e.g., fiber samples from a known carpet). Make a complete evaluation of the crime scene.
10. Record and collect physical evidence: Photograph all items before collection, and document on the photographic log. Mark evidence locations on the sketch, and complete the evidence log with notations for each item of evidence. As previously set forth, have one person serve as evidence custodian. Two persons should observe the evidence in place during recovery and mark evidence for identification. Mark directly on the evidence when feasible; otherwise, place identifying marks on packaging. Constantly check paperwork, packaging, and other information for errors.
11. Final survey: The final survey is a review of all aspects of the search. Discuss the search with all personnel and ensure that all documentation is correct and complete. Photograph the scene showing the final condition. Ensure that all evidence is secured and that all equipment is retrieved. Ensure that hiding places or difficult access areas have not been overlooked.
12. Release: Release the crime scene after the final survey. Documentation for the release of the crime scene should include the time and date of release, to whom released, and by whom released. Ensure that the evidence is collected according to legal requirements, documented and marked for identification. If a search warrant was used, leave a copy of the warrant and receipt. Consider the need for specialists (e.g., a blood pattern analyst or medical examiner) to observe the scene before it is released. Once the scene is released, reentry may require a warrant, so the scene should be released only when all personnel are satisfied that the scene was searched correctly and completely. Only the person in charge should release the scene.

The following case histories are typical of situations to which FBI ERTs as well as other law enforcement agencies respond on a daily basis across the world. They

serve here to present the applications of the above protocols and responsibilities toward efficiently and accurately putting together the often mixed and confusing pieces of crime scene puzzles.

Recovery of a Multiple Victim Burial

Recent American history mercifully lacks a chapter involving mass genocide or the clandestine, mass internment of homicide victims. Obviously, the histories of Western Europe (Abarinov 1993), the Balkans (Bax 1997; Calabrese 1994; Cigar 1995; Djuric 2004; Komar 2003; Primorac et al. 1996; Skinner et al. 2003), Southeast Asia (Dodd 2000), Central and South America (Binford 1996; Danner 1993; Doretti and Snow 2002; La Fundación de Antropologia Forense de Guatemala 2000; Manuel and Stover 1991; McCleskey 1983), as well as Africa (Connor 1996a, b; Haglund 1997; PHR 1996; Snow 1994) and the Middle East (Briscoe and Snow 1993; PHR 1992; Scott and Connor 1997; Stover et al. 2003) do not share this attribute. The above-mentioned works have documented the recovery and forensic examination of victims from the mass graves of the Holocaust to the horrors of 1994 Rwanda, and more recent atrocities uncovered in Iraq.

The closest we come in the contemporary United States to mass graves are investigations of homicides in which two or more victims were killed and interred contemporaneously. In ongoing research first presented in 1999, one of the authors has reviewed 920 homicide cases in which victims' remains have been reported as buried (Hochrein et al. 1999). Of those 920 cases dating from 1951 to 1997, 143 (15%) were reported as involving the burial of two or more persons. Of those 143 cases, 55 (6% of the total cases reviewed and 38% of those involving multiple homicides) described the burial of multiple victims in common graves. Examples include the triple homicide committed by Christopher Hightower in 1991. The common grave of two of his victims was found near Barrington, Rhode Island, two months after their murders. Tony Carruthers used a recently dug grave shaft in a Memphis, Tennessee cemetery to conceal the bodies of three of his victims beneath a legitimate burial in 1994. In 1990, cult leader Jeffrey Lundgren directed the murders and mass burial of five of his followers on a Kirkland, Ohio, farm. And serial killers Dean Corll and Elmar Henley buried 17 of their 26 victims beneath a Galveston, Texas, boat shed during the early 1970s.

Among the multiple victim interments excavated by one of the authors was that of four victims associated with the subject of an illegal drug investigation. The forensic recovery of remains in that case demonstrates how proper forensic archaeological techniques, applied in the scheme of the overall ERT protocols outlined above, can lessen complications during their forensic physical anthropological analyses and create a more meaningful product for courtroom presentation. In that case a drug dealer learned that one of his partners had provided information to law enforcement investigators and would testify against him in an upcoming trial. With the assistance of a girlfriend, the drug dealer drove the partner, his girlfriend, and her two children to a rural wooded setting and shot them. The girlfriend and her 6- and

10-year-old daughters were innocent victims. The dealer's partner came to live with them a week before their murders. All of the bodies were then buried in a common grave. Seven years later the events of that night were described for investigators by a jailhouse informant who had heard them from the dealer's girlfriend. Using hand-drawn sketches and the verbal description given to the informant, investigators were able to locate two graves containing a total of five victims. One was a single grave located near the edge of a Midwest cornfield containing the body of a second partner. The other, holding the remains of the four victims described above, was found in a wooded flood plain along a country road. The searches of both scenes were coordinated with local, State, and Federal case investigators while following the ERT protocols.

Evidence Response Teams from the FBI's Omaha and St. Louis Divisions were requested to assist in the location and excavation of the graves. Initially unable to find that of the second partner, buried alone, the team concentrated its efforts on the grave, which would eventually be found to contain the remains of two adults and two children identified as the first partner, his girlfriend, and her 6- and 10-year-old daughters. The FBI ERT protocol used in this and other forensic archaeological excavations entailed the use of minimally intrusive techniques to first confirm the presence of buried evidence. This was followed by the systematic excavation, documentation, and removal of biological, cultural, and geotaphonomic evidence from the grave. Throughout that process team members trained in specific techniques were assigned duties of photography, excavation, mapping, inventory/packaging, etc. Overseeing the safety and needs of the team members and assisting personnel was the team leader. Among the team leader's responsibilities were ensuring site security and arranging work shifts, water, meals, and accommodations in order that the crime scene could be processed over two days without interruption. The team that addressed this site consisted of members from two different FBI Divisions and a supervisor for the Evidence Response Team Unit. The ERT Unit also provided geophysical prospecting equipment and operators. The excavation was directed by a team member who had postgraduate training and professional experience as an archaeologist before joining the FBI. Two assistant excavators and two photographers documented the scene in diagrams and photographs. Three additional team members and three non-ERT investigators shared responsibilities of screening, evidence packaging and logging, supply requests, etc.

Following the confirmation of a buried anomaly using ground-penetrating radar and soil core sampling, a small pit or "window" was excavated in the approximate center of the grave to determine the depth and nature of the buried evidence. This preliminary, or exploratory, excavation also demonstrated one problem commonly encountered with commingled skeletal elements whether buried or deposited on the surface: mixed nonhuman and human bones (Outram et al. 2005). The excavation window not only confirmed the presence of human remains but also those lying in direct association that were clearly of nonhuman origin. They would later be identified as those of a short-tailed shrew (*Blarina brevicauda*) and opossum (*Didelphis virginiana*) (Fig. 3.1).

Fig. 3.1 Close-up of opossum and shrew bones commingled with those of Individual 1 at the base of the test excavation window (photo by Lavone Tienken)

A nonforensic, nonarchaeological, less systematic excavation of the grave may have resulted in the collection of both the human and nonhuman bones, which could be separated later. What would have been lost, however, would have been the contextual explanation for how the opossum and shrew came to be buried with the human victims. In this case, the excavation and three-dimensional mapping revealed, and allowed documentation of, an in-filled burrow, or krotovina, which extended from above the torso of Individual number 1 (later identified as the first partner mentioned above), toward and through the northeast corner of the grave. It was above Individual 1's chest that the opossum and shrew bones were excavated in what was identified as a chamber in the in-filled krotovina (Fig. 3.2). With the geotaphonomic and archaeological information preserved, it was possible to reconstruct how an abandoned burrow was used by a wintering opossum, which then died. Without the use of strict archaeological protocols, the commingled bones could have easily been misinterpreted as an intentional placement of road kill over the bodies to further conceal them from humans or animals curious about the disturbed ground.

Once a clandestine human burial was confirmed through the excavation window, a grid system for three-dimensional mapping and photographic purposes was established over the grave. Using the grid units, initially, as arbitrary boundaries, the excavation window was expanded across the grave at 5- to 10-centimeter (1.97- to 3.94-inch) arbitrary levels until the outline of the feature was visible. This was the point at which a system of krotovinas, which explained the commingled nonhuman and human remains, was first realized and recorded.

The second hazard of commingled remains in this case involved the excavation and collection of the victims' remains. Although each of the victims was clothed at the time of burial, the years that had lapsed until their recovery allowed time for

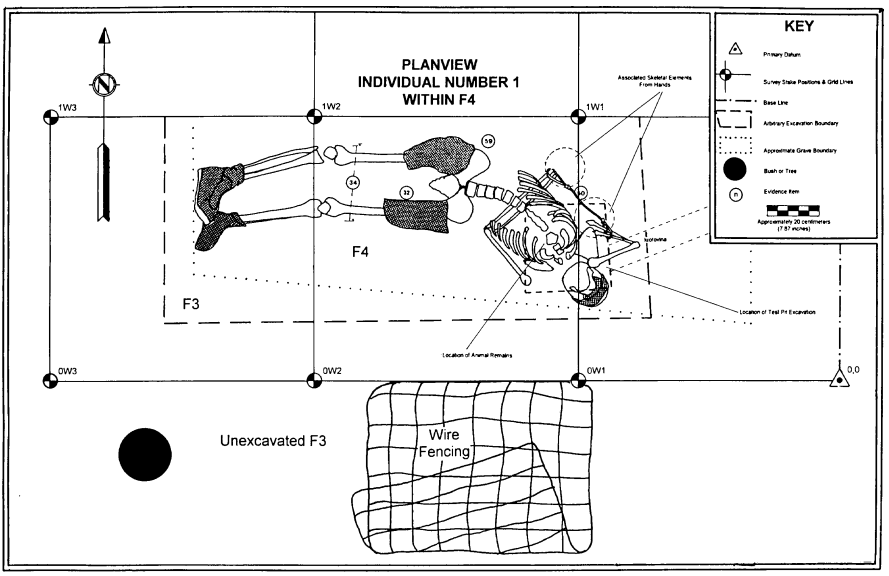

Fig. 3.2 Planview of Individual No. 1 showing the position of the krotovina in relationship to human remains and the excavation test window

the natural fibers of shirts and pants to disintegrate. With the exception of Individual 4 (later identified as the 6-year-old daughter), buried at the bottom of the pit with her head covered by a shirt, there was very little soft tissue present. Without any soil thrown into the pit between each victim, the skeletal elements from one were in direct contact with those beneath or above. An unfortunate fact of forensic archaeology, unlike the archaeology of funded academic research projects, is that they more often than not fall under relatively severe time and budgetary constraints. In spite of their relationship to cases of life and death, pressures are placed on the crime scene investigators to collect evidence as quickly as possible. Combined with limited manpower and supplies, this often calls for developing "shortcuts" to increase efficiency during the excavation. The author made the decision in this case to collect the small skeletal elements comprising victims' hands and feet en masse rather than the detailed and time-consuming excavation and mapping of individual carpal and phalangeal bones. Once uncovered, the area of each hand or foot was minimally revealed, and then the matrix or block of soil containing exposed bones and fingernails was removed, screened separately through ¼-inch hardware cloth and, at times, the smaller-gauge mesh of geology sieves. The items recovered from the screen were then packaged separately as coming from respective victims. Using this technique, some of the elements from different individuals' hands became mixed because of their close proximity to another's. That tradeoff of lessened time in the field versus extra time spent by the forensic physical anthropologist in the morgue or laboratory is often associated with situations of commingled remains.

For the crime scene reconstructionist and criminal investigator, the exact position of each victim's hands and fingers may be a critical piece of the investigative puzzle they are tasked with putting together. The position and orientation of such elements to weapons or terminal ballistic evidence obviously impact scene interpretations and therefore legal strategies. The intentional positioning, or staging, of bodies has been documented as a signature used by killers and could include the victim's hands. The position of the hands in relation to other areas of the body such as the head or face could be interpreted as defensive posture. In hindsight, the position of the victims' hands in the presented case could have impacted what the jury imagined may have taken place at the time of death and burial. Valid or not, the image of a mother's hand touching or holding those of her child in the same grave could have tremendous impact among some jury members. The mapping of each phalange or carpal bone may not be necessary in the documentation of every clandestine burial but should not be ruled out as nonprobative. That determination can only be made when the case detectives or agents consider all of the physical, testimonial, and circumstantial evidence they have available. The forensic archaeologist or crime scene technician is not in a position to make that decision and should always try to collect the maximum amount of information without assumptions.

In the instant case, the practice of using outside specialists was demonstrated through consultations with a forensic mammalogist from the Department of the Interior, Fish and Wildlife Service and botanists from the Missouri Botanical Gardens and the University of Missouri. It continued with the medical examiner's employ of a qualified and experienced forensic physical anthropologist and odontologist. As assistance to those specialists, and especially the forensic anthropologist, the human remains were transferred from the grave, following photography and mapping, to steriles white fabric sheets in the same position they were revealed through excavation. All clothing, ligatures, gags, etc. were maintained as found over or among the skeletal elements of respective individuals. If possible, arm, leg, and other anatomical positioning was preserved as the remains were placed on the sterile sheet. Associated remains such as the bones of the hands or feet, which were excavated and screened en bloc, were packaged separately and then wrapped with the individual with whom they were associated. Once wrapped in the fabric sheet, an additional plastic sheet was used to package and label each victim's remains. (Note: Packaging of biological evidence in plastic is generally not recommended unless, as in this situation, the evidence was immediately transported to a laboratory setting and examined soon after.)

The expert examinations of the remains were accomplished by a forensic anthropologist, forensic odontologist, and DNA specialist as coordinated by the direction of the Medical Examiner's Office. Their analyses confirmed the identities of the victims as the drug dealer's partners, his girlfriend, and her two daughters. The demographic differences between the victims assisted not only in their identifications but also in the separation of skeletal elements commingled during burial and excavation. In spite of commingling of some of the smaller skeletal elements, the careful, systematic excavation and packaging preserved trace evidence and ballistic evidence

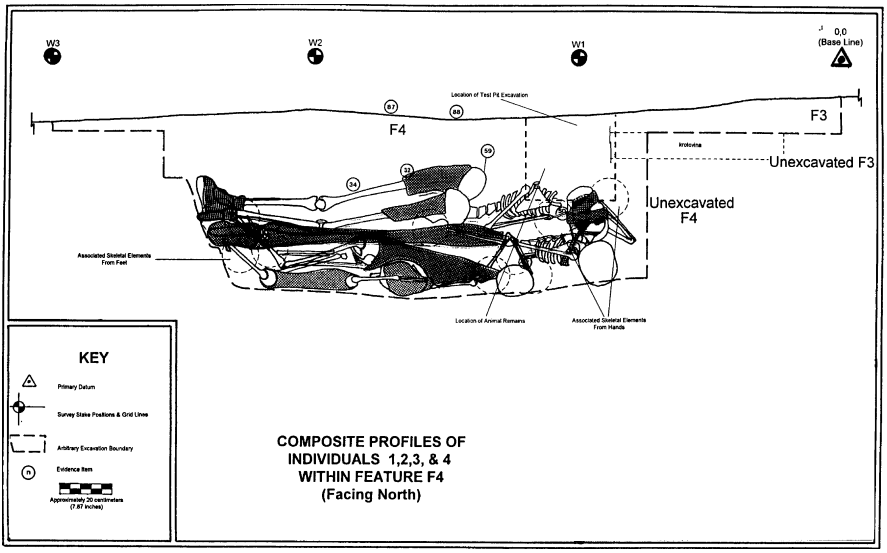

Fig. 3.3 Elevation view diagram demonstrating the proximity of each victim to the other with the location of hand bones circled

associated with respective victims. Again, if the excavation had simply entailed uncovering the remains and pulling them out of the ground without a detailed record of their positions, the relationship of ballistic and other critical evidence may have been lost or confused between individuals. The forensic anthropologist in this case was provided contextual information through notes, three-dimensional diagrams, and photographs. These were then available to be used in concert with the remains themselves toward taphonomic interpretation of perimortem and postmortem trauma as well as antemortem pathologies. The forensic anthropologist determined that each victim was shot in the head, with the adults suffering additional traumas.

Clearly, the implementation of basic ERT protocols enhanced the ability of each expert involved in this case. The crime scene reconstruction was ultimately found to be consistent with testimony and other evidence used in the trials of each suspect. The presentation of crime scene diagrams alongside crime scene photographs allowed the jury to revisit the scene and clearly understand what each medium alone could not completely demonstrate. Both suspects in this case were found guilty.

Recovery of Multiple Victims from an Airplane Crash

The United States is obviously no stranger to mass disasters both accidental and criminal. The smallest of these scenes may involve only a few individuals but can entail hundreds or thousands of pieces dispersed over several acres, or concentrated within the more confined area of a deep-impact crater. An example of the first type of

scene resulted from the October 16, 2000, crash of a small aircraft carrying Missouri Governor Melvin Carnahan, his son Roger Carnahan, and the governor's campaign aide, Christopher Sifford (Fig. 3.4).

During the evening of October 16, 2000, weather conditions combined with equipment problems and pilot error to caused the governor's Cessna 335 to barrel into a heavily wooded hillside near Goldman, Missouri. A small impact crater [1.5 meters (5 feet) wide, 3.0 meters (10 feet long), and 1.2 meters (4 feet) deep] and a stand of sheered trees evidenced the point of impact for the fixed-wing aircraft. Approximately 30.5 meters (100 feet) away from the crater, in the apparent direction of travel, were the twisted and abbreviated remnants of the cockpit and fuselage, which came to rest against a group of trees (Fig. 3.5). With the exception of the horizontal stabilizers and the aft upper fuselage skin, the airframe structure separated into small ($6 \times 6 \times 12$ inch) and medium-sized ($12 \times 12 \times 24$ inch) pieces of debris (NTSB 2002). The distance from the farthest piece of wreckage, a right engine crankshaft, was 274.3 meters (900 feet). A small amount of debris landed as far as 30.5 meters (100 feet) behind the impact crater. The maximum width of the debris field was 76.2 meters (250 feet).

An often ignored, or less often considered, dimension of the terrestrial mass disaster site is that of elevation. At the Carnahan crash site, the problems associated with debris and remains landing in the tree canopy were compounded by the area's steep terrain. Another three-dimensional aspect on any wooded crash site is recording evidence that will help to reconstruct flight dynamics before and after impact. Specifically, the height of damaged and undamaged trees, combined with

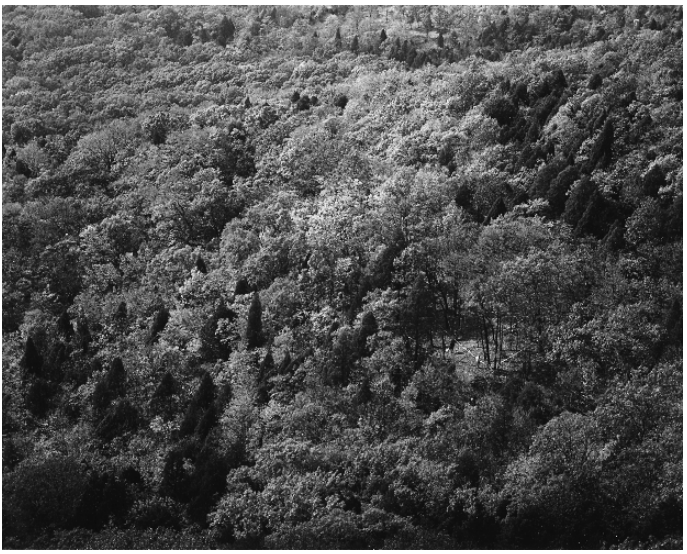

Fig. 3.4 Aerial photograph of Goldman, Missouri, crash site demonstrating the remote and rough terrain (photo by Richard G. Marty Jr.)

Fig. 3.5 Photograph of the extremely fragmented remains of the cockpit/fuselage (photo by Richard G. Marty Jr.)

the orientation (right and left) of aircraft parts on the ground, helps to determine the attitude at which the aircraft entered the canopy and impacted as well as whether it was right side up or upside down. With information collected by the Missouri State Highway Patrol, as well as the St. Louis and Springfield Division Evidence Response Teams, the National Transportation Safety Board Investigators were able to create a three-dimensional model of the airplane flight path through the trees.

Fig. 3.6 Recovered airplane components laid out for reconstruction and again, demonstrating severe fragmentation (photo by Richard G. Marty Jr.)

They determined the airplane was in a 16° to 18°, right-wing-down attitude during its entry into the trees. Although no computerized video reconstruction of the crash is included in the NTSB's Aircraft Accident Brief for this crash, at least one figure depicts a side view of the broken tree tops left in the aftermath of the crash (NTSB 2002).

The volume of evidence mentioned above as well as that of crash victims, including crew and passenger positions and their proximity to localized aircraft damage (i.e., holes in the fuselage or blast-related evidence), can become overwhelming in any setting, let alone those complicated by rough terrain and thick woods. Without sophisticated mapping technology such as the electronic total station, the collection of spatial data that may reflect patterns in the distribution of otherwise commingled evidence would be difficult and incomplete. Two weeks prior to the crash of Governor Carnahan's airplane, the FBI's St. Louis Division ERT sponsored a medicolegal field school in the recovery of human remains. One of two final practical exercises in that school involved the search, mapping, and recovery of evidence from the simulated crash of a small fixed-wing aircraft using search and recovery protocols described in Dirkmaat et al. (2001). Attendees from across the United States, and especially from the State of Missouri, utilized a combination of mapping techniques from the simplest to the most sophisticated. They recorded the positions of 400 simulated human remains, plane parts, and topography across a debris field encompassing 4,905 square meters (52,800 square feet). The Terrestrial Mass Fatality Scene Protocol introduced in that training includes four steps: (1) search and location effort; (2) total station data collection and assignment of field specimen numbers; (3) photographic documentation; and (4) physical evidence collection and preservation (Dirkmaat et al. 2001). Some of the attendees of that school found themselves as first responders at the scene of their governor's death. Their experience and training in the above-mentioned protocols, in collaboration with the FBI ERT members' familiarity with ERT protocols, as well as the Highway Patrol's expertise in total station mapping caused the joint agency team of responders to realize the efficiency and accuracy of using such methods and technology. As a result, the Terrestrial Mass Fatality Scene Protocol was easily applied in the scheme of the general FBI ERT methods outlined above.

First applied in a commercial air disaster at the crash site of United Flight 427 near Pittsburgh, Pennsylvania, in September 1994 (Dirkmaat et al. 1995), electronic total stations, or laser measuring devices, are now required by the NTSB in the documentation of mass transportation disasters. The Missouri Highway Patrol combined the FBI ERT training they received little more than a week before and their expertise in using multiple total stations for highway accident reconstructions to maximize the information they could get from the Goldman, Missouri, crash site. Shortly after meeting with various investigative teams, two total stations were brought to the crash site. One was devoted to recording the position of human remains marked by search teams, while the second was devoted to mapping the location of diagnostic airplane parts identified by FAA and corporate engineers. The remaining, nondiagnostic airplane debris would be collected using a reference system of 30 sectors established across the scene.

The dedication of two total stations was well conceived and seamlessly applied in the method mentioned above. However, the use of the technology would later reveal another complication that may arise in documenting different categories of commingled evidence. The numbering system used by the total station operators was not mutually exclusive. This meant that a piece of human remains numbered, for example, "1505" corresponded to that shot recorded by one total station, while a piece of aircraft might also be assigned "1505" using the second total station dedicated to aircraft components and other nonhuman remains evidence. A problem occurred in merging the information obtained by the two machines because there was not a mutually exclusive numbering system. This was corrected by the FBI's Investigative and Prosecutive Graphics Unit when each total station's raw data were sent in from the field. However, respective, exclusive numbering systems applied to each type of crash evidence in the field could have saved time devoted toward interpreting the data.

As shown in the first case history, problems are encountered in most scenes of commingled evidence. The formulation, application, and maintenance of appropriate recovery methodologies will lesson the impact of those problems or allow for their correction. The contextual recovery of evidence at the Goldman, Missouri, crash site served as the basis for the NTSB's reconstruction and conclusions regarding this accident (NTSB 2002). The data collected were not only accurate but

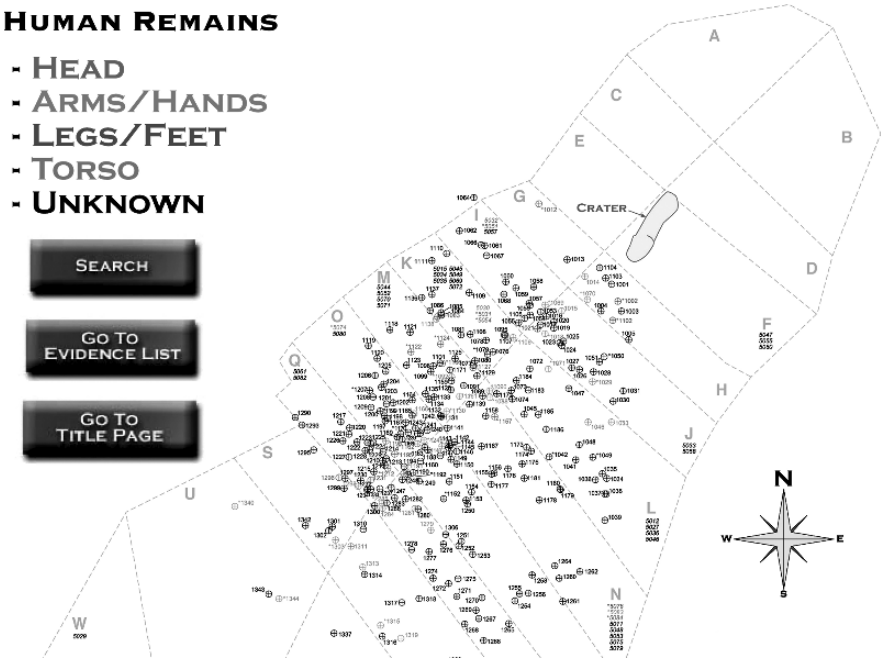

Fig. 3.7 Interactive total station diagram showing the distribution of human remains across the crash site (diagram created by Paula Ernst)

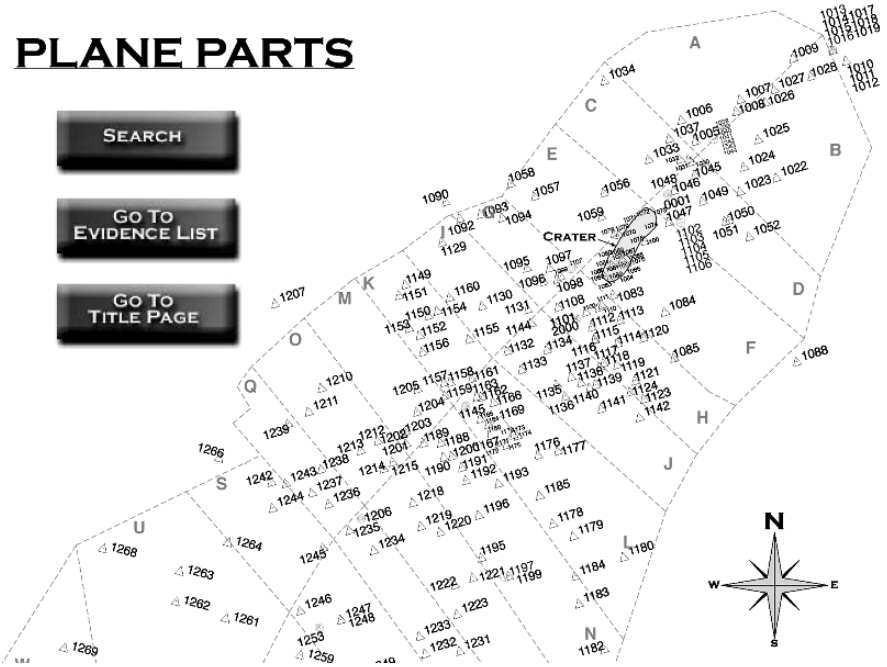

Fig. 3.8 Interactive total station diagram showing the distribution of diagnostic aircraft components across the crash site (diagram created by Paula Ernst)

allowed the FBI's Investigative and Prosecutive Graphics Unit, for the first time in a mass disaster scene, to create an interactive computerized crime scene diagram. Investigators interested in the description of a particular piece of human remains or an aircraft part could simply position the arrow on the computer screen over the item number on a two-dimensional plan view and receive a written description. When the same number or position was double-clicked, a digital image of the fragment would appear. Maps of human remains could be separated from nonhuman evidence and were coded by body part (Figs. 3.7 and 3.8). The impact on future air disaster investigations includes an ability to study potential patterns created by the distribution of human remains and debris in light of recorded and witnessed crash events.

Conclusions

The two cases presented above, as examples of the application of formal protocols by FBI ERTs, demonstrate complications that may arise in dealing with commingled evidence including human remains. More so, however, they demonstrate the value and efficiency of such planned, structured methodologies toward compiling accurate reconstructions of seemingly chaotic collections of evidence. Gone should

be the days when medical examiners and the experts they employ are presented with bags of bones simply picked up from a scene. Where investigators once relied on such experts to help solve crimes solely from clues found on the bodies, we can now collect as much, if not more, from subtle clues contained in the recorded contexts of those remains. In cases such as the clandestine mass grave described above, three-dimensional data can offer, among other information, information concerned with (1) the sequence in which victims were deposited, (2) whether or not the victims were shot before deposition or after they were placed in the grave, (3) postburial disturbances such as attempts to relocate or further conceal bodies, and (4) the relocation or absence of evidence due to bioturbation. Similarly, the mass collection of evidence from general areas throughout a crash scene is no longer acceptable in the light of developed protocols and applications of laser technologies, as seen in the aforementioned air crash investigation. The three-dimensional processing of individual items commingled through a crash site may offer insight into (1) flight and impact dynamics, (2) peri- or postimpact explosions versus in flight explosions, (3) passenger and crew positions, and (4) postimpact disturbances via human or nonhuman scavenging. The patterns left in the aftermath of natural and manmade disasters, or criminal conduct, are as unique as the factors that caused them. Only by collecting evidence in a manner that allows us to analyze all of the evidence offered in a scene in context can we begin to accumulate data sets that are comparable between crime scenes or mass disaster scenes. The ability to compare evidence patterns between more and more scenes will lead to an ability to more accurately create interpretive models toward solving crimes and perhaps predictive models for preventing future events.

Acknowledgments The authors would like to thank each and every FBI ERT for their efforts and dedication. Special thanks are offered to members of the Omaha, St. Louis, and Springfield teams. Their efforts contributed to the successful resolution of the cases presented herein. Likewise, the expertise of those who work within the FBI's Investigative and Prosecutive Graphics Unit has helped to continuously advance FBI ERTs in data collection and interpretation.

References Cited

Abarinov, V. 1993 *The Murderers of Katyn*. Hippocrene Books, New York.

Anker, R. and F. Taylor 1989 The Trajectories of Falling Parts Following In-Flight Breakup. Paper presented at the 20th International Society of Air Safety Investigators Forum International Seminar.

Barrie, H. J. and N. Hodson-Walker 1970 Incidence and pathogenesis of fractures of the lumbar transverse processes in air crashes. *Aerosp. Med.* 41(7):805–808.

Bax, M. 1997 Mass graves, stagnating identification and violence: A case study in the local sources of "the war" in Bosnia Herzegovina. *Anthropol. Q.* 70(1):11–19.

Bergen-Henengouwan, S. G. 1973 *Aircraft Wreckage Trajectory Analysis User Manual*. Aeronautical and Mechanical Engineering Department, Southern Alberta Institute of Technology, Calgary, Alberta, Canada.

Binford, L. 1996 *The El Mozote Massacre: Anthropology and Human Rights*. The University of Arizona Press, Tucson.

Briscoe, J. and C. C. Snow 1993 Archaeological report on Koreme, Birjinni and Jeznikam-Beharke cemetery. In *The Anfal Campaign in Iraqi Kurdistan: The Destruction of Koreme*. Human Rights Watch, Washington, DC.

Brooks, P. 1985 Crime scene and profile characteristics of organized and disorganized murderers. *FBI Law Enforcement Bull.* (August).

Burgess, A. W. and R. K. Ressler 1985 *Sexual Homicide Crime Scenes and Patterns of Criminal Behavior: Final Report*. Boston City Health and Hospitals Department, Boston.

Calabrese, C. 1994 Report from the Balkans: Investigating mass graves for the U.N. *Fed. Archaeol.* 7(2):9.

Cigar, N. 1995 *Genocide in Bosnia: The Policy of Ethnic Cleansing*. Texas A&M Press, College Station, TX.

Connor, M. A. 1996a Archaeologists and the United Nation tribunals. *CRM* 19(10):32.

Connor, M. A. 1996b The archaeology of contemporary mass graves. *Soc. Am. Archaeol. Bull.* 14(4):6–31.

Danner, M. 1993 *The Massacre at El Mazote*. Vintage Books, New York.

Dirkmaat, D. C., J. T. Hefner, and M. J. Hochrein 2001 Forensic Processing of the Terrestrial Mass Fatality Scene: Testing New Search, Documentation, and Recovery Methodologies. Paper presented at the 53rd Annual Meeting of the American Academy of Forensic Science, Seattle, WA.

Dirkmaat, D. C., A. Quinn, and J. M. Adovasio 1995 New methodologies for search and recovery. *Disaster Management News* (December):1–2.

Djuric, M. P. 2004 Anthropological data in individualization of skeletal remains from a forensic context in Kosovo—A case history. *J. Forensic Sci.* 49(3):464–468.

Dodd, M. 2000 A report from the killing fields—The East Timor experience. *InForMed* 5(3):21–26.

Doretti, M. and C. C. Snow 2002 Forensic anthropology and human rights: The Argentine experience. In *Hard Evidence: Case Studies in Forensic Anthropology*, D. W. Steadman, ed., pp. 90–310. Prentice Hall, Upper Saddle River, NJ.

Douglas, J. E. and C. Munn 1992a Violent crime scene analysis. *Homic. Invest. J.* (63):69.

Douglas, J. E. and C. Munn 1992b Violent crime scene analysis: Modus operandi, signature and staging. *FBI Law Enforcement Bull.* (61):2.

Douglas, J. E., R. K. Ressler, A. W. Burgess. and C. R. Hartman 1986 Criminal profiling from crime scene analysis. *Behav. Sci. Law* 4(4):401–421.

Gable, W. D. 1968 Pathology patterns in aircraft accident investigation. *Aerosp. Med.* 39(6): 638–640.

Haglund, W. D. 1997 *Report of the Exhumation and Examination of Remains from the Kibuye*. Physicians for Human Rights, Boston.

Hellerich, U. and S. Pollak 1995 Airplane crash. Traumatologic findings in cases of extreme body disintegration. *Am. J. Forensic Med. Pathol.* 16(4):320–324.

Hill, I. R. 1989 Mechanism of injury in aircraft accidents: A theoretical approach. *Aviation, Space, and Envir. Med.* 60(7):A18–25.

Hochrein, M. J. 1997 Buried crime scene evidence: The application of forensic geotaphonomy in forensic archaeology. In *Forensic Dentistry*, P. G. Stimson and C. A. Mertz, eds., pp. 83–99. CRC Press, Boca Raton, FL.

Hochrein, M. J. 2002 An autopsy of the grave: Recognizing, collecting, and preserving forensic geotaphonomic evidence. In *Advances in Forensic Taphonomy: Method, Theory, and Archaeological Perspectives*, W. D. Haglund and M. H. Sorg, eds., pp. 45–70. CRC Press, Boca Raton, FL.

Hochrein, M. J., J. Gabra, and S. P. Nawrocki 1999 The Buried Body Cases Content Analyses Project: Patterns in Buried Body Investigations. Paper presented at the American Academy of Forensic Science, Orlando, FL.

Keppel, R. D. 2005 Serial offenders: Linking cases by modus operandi and signature. In *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd ed., S. H. James and J. J. Norby, eds., pp. 605–614. CRC Press/Taylor and Francis Group, Boca Raton, FL.

Komar, D. 2003 Lessons from Srebrenica: The contributions and limitations of physical anthropology in identifying victims of war crimes. *J. Forensic Sci.* 48(4):713–716.

Kreft, S. 1970 Who was at the aircraft's controls when the fatal accident occurred? In *Aerospace Pathology*, p. 96. College of American Pathologists Foundation, Chicago.

La Fundación de Antropologia Forense de Guatemala 2000 *Informe de las Invetigaciones Antropológico Forenses e Históricas*. Report of Investigations, 1997–1998. Editorial Serviprensa, Guatemala City.

Lundrigan, S. and D. Canter 2001 Spatial patterns of serial murder: An analysis of disposal site location choice. *Behav. Sci. Law* 19(4):595–610.

Manuel, A. and E. Stover 1991 *Guatemala: Getting Away with Murder*. America's Watch and Physicians for Human Rights, Washington, DC.

Matteson, F. H. 1974 Analysis of wreckage patterns from in-flight disintegrations. *J. Safety Res.* (6):60–71.

McCleskey, K. 1983 Medical mission to El Salvador investigates cases of "disappeared." *Science* (219):1209–1210.

Min, J. X. and M. Z. Jia 1992 Correlation of trauma and cause of death to accident reconstruction: A case of a flight accident report. *J. Forensic Sci.* 37(2):585–589.

NTSB 2002 *Aircraft Accident Brief: Accident Number CHI01MA011, Cessna 335, N8354N, Hillsboro, Missouri, October 16, 2000*. http://www.ntsb.gov/publictn/2002/AAB0202.pdf.

Outram, A. K., C. J. Knüsel, S. Knight, and A. F. Harding 2005 Understanding complex fragmented assemblages of human and animal remains: A fully integrated approach. *J. Archaeol. Sci.* 32(12):1699–1710.

Outram, A. K., C. J. Knüsel, S. Knight, and A. F. Harding PHR 1992 *Unquiet Graves: The Search for the Disappeared in Iraqi, Kurdistan*. Physicians for Human Rights and Middle East Watch,.

1996 *PHR Investigates Mass Graves in Rwanda*. Physicians for Human Rights, .

Primorac, D., S. Andelinovic, M. Definis-Gojanovic, I. Drmic, B. Rezic, M. M. Baden, M. A. Kennedy, M. S. Schanfield, S. B. Skakel, and H. C. Lee 1996 Identification of war victims from mass graves in Croatia, Bosnia, and Herzegovina by use of standard forensic methods and DNA typing. *J. Forensic Sci.* 41(5):891–894.

Rajs, J., M. Lundstrom, M. Broberg, L. Lidberg, and O. Lindquist 1998 Criminal mutilation of the human body in Sweden—A thirty-year medico-legal and forensic psychiatric study. *J. Forensic Sci.* 43(3):563–580.

Ressler, R. K., A. W. Burgess, R. L. DePue, J. E. Douglas, R. R. Hazelwood, K. V. Lanning, and C. Lent 1985 Crime scene and profile characteristics of organized and disorganized murderers. *FBI Law Enforcement Bull,* (54):18–25.

Rossi, D. 1982 Crime scene behavioral analysis: Another tool for the law enforcement investigator. *The Police Chief* (January):152–155.

Scott, D. D. and M. Connor 1997 The Koreme execution site: A modern crime scene investigation using archaeological techniques. In *Forensic Taphonomy: The Postmortem Fate of Human Remains*, W. D. Haglund and M. H. Sorg, eds. CRC Press, Boca Raton, FL.

Skinner, M., D. Alempijevic, and M. Djuric-Srejic 2003 Guidelines for international forensic bio-archaeology monitors of mass grave exhumations. *Forensic Sci. Int.* 134(2–3):81–92.

Snow, C. C. 1994 *Observations on Human Skeletal Remains Excavated from Grave 1 Kotebe, Ethiopia*. Special Prosecutor's Office.

Steele, R. M. G. 1983 Trajectory plots of aircraft debris following in-flight break-up. Unpublished Master's of Science Thesis, Cranfield Institute of Technology, England.

Stover, E., W. D. Haglund, and M. Samuels 2003 Exhumation of mass graves in Iraq: Considerations for forensic investigations, humanitarian needs, and the demands of justice. *JAMA* 290(5):663–666.

Swegennis, R. W. 1987 Impact angles and velocities. In *Safety Investigation: Investigative Techniques*, B. Carver, ed., pp. 1–16. Department of the Air Force, Washington, DC.