Human Identification in a Post-9/11 World: Attack on American Airlines Flight 77 and the Pentagon

Identification and Pathology

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On September 11, 2001, American Airlines Flight 77 was hijacked by five terrorists as part of a coordinated attack on the United States that also involved the hijackings of American Airlines Flight 11 (which was flown into the North Tower of the World Trade Center), United Airlines Flight 175 (which was flown into the South Tower of the World Trade Center), and United Airlines Flight 93 (which crashed in a field in Shanksville, Pennsylvania). AA Flight 77 was intentionally crashed into the Pentagon, killing all 64 people on board the aircraft (terrorists, flight crew, and passengers) and 125 people (military and civilian) in the building. The fact that this was a terrorist attack targeting the nerve center of the U.S. Department of Defense made the identification and handling of the human remains significantly different than a "typical" mass disaster.

The responsibility to identify and autopsy each of the decedents fell to the Office of the Armed Forces Medical Examiner, part of the Armed Forces Institute of Pathology, headquartered in Washington, DC. All of the human remains–of which there were more than 2000 separate specimens–were moved to the U.S. Air Force Port Mortuary at Dover AFB, Delaware, for evaluation. There, a multidisciplinary team of pathologists, dentists, anthropologists, fingerprint specialists, radiologists, DNA technologists, photographers, morticians, and support personnel used a systematic, stepwise approach to ensure that every scientifically available method was utilized to maximize the number of victims that could be positively identified, reassociated, and returned to the families.

This presentation will open with an overview of forensic human identification, discussing the relative strengths and weaknesses of the various forms of presumptive and scientific human identification and highlighting the contributions of dentistry, anthropology, fingerprinting, DNA, and radiology. The presentation will then go inside the mortuary, showing every step in the identification process and explaining the rationale for the identifications and examinations.

Following approximately 2½ weeks of remains processing and two months of DNA analysis, 183 unique identities were generated from the remains of those killed in the attack on the Pentagon, yielding 178 positive identifications. Some remains for each of the terrorists were recovered, as evidenced by five unique postmortem profiles that did not match any antemortem material provided by victims' families. No identifiable remains for five of the victims known to have been killed in the attack were recovered.

Any opinions in this handout are those of the speaker, and do not necessarily reflect the views of the Office of the Armed Forces Medical Examiner, the Armed Forces Institute of Pathology, or any other Federal agency.

One of the major goals in any mass fatality situation, or in any death investigation, is the confirmation of the identity of the decedent(s). Methods of identification are often classified into scientific methods (also called positive or definitive identification) and nonscientific methods (also called tentative or presumptive identification).

Nonscientific methods

Nonscientific identification yields presumptive identification of an individual – either putting a likely or tentative name on a decedent, or at least putting that decedent in a smaller subgroup of the population. Potential names may then be used to track down more antemortem data on an individual.

- **Visual identification** by a family member or friend (ideally backed up by a photographic identification, such as a driver's license or passport) – in non-disaster situations where the body of a decedent is viewable, this method is routinely used by medical examiners and coroners and is considered adequate for identification.
- **Circumstantial findings** may yield a tentative name (or list of names) – the address of the house in which the body is found, the license number of a car in which remains are found, the manifest of an airline flight, etc.
- **Basic physical attributes** (height, weight, hair and eye color) may allow rapid exclusion of an individual from consideration.
- **Personal effects**, such as wallets, purses, watches and jewelry, dentures, canes, etc., may have useful identifying information
- **Distinguishing marks** – scars, birthmarks, tattoos

The power of nonscientific methods of identification in a mass fatality situation may become sorely limited: burned or fragmented bodies cannot be visually identified, physical attributes and distinguishing marks are obscured by trauma or postmortem changes, and personal effects become dissociated from human remains.

Scientific methods

Scientific identification is predicated on the comparison of a known antemortem specimen with a known postmortem specimen, with a match essentially excluding every other person on earth.

Fingerprints

Advantages

- Relatively rapid if the antemortem record is available
- Many adult individuals (and often children) have been fingerprinted at some time, for various reasons
- No two individuals have ever been shown to have the same set of fingerprints
- Fingerprints do not change over the course of an individual's lifetime
- Theoretically possible to get a "cold hit" on an unknown decedent when the fingerprint(s) are entered into a database

Disadvantages

- Fingerprinting only works on remains with fingers – in a mass disaster situation, many remains will be fragmented, burned, or both
- Antemortem fingerprint cards may not be readily retrievable
- Requires expertise in fingerprint comparison

Dental

Advantages

- Relatively rapid if the antemortem record is available
- Nearly every adult and older child in the developed world is likely to have some dental records (charts, radiographs) somewhere
- Surviving family members usually know where a loved one got dental care, or insurance companies can be queried to find the decedent's dentist
- Teeth can survive trauma and temperature well beyond that required to destroy fingers or other human tissue

Disadvantages

- Dental identification only works on remains with dentition (in some cases, may work with mandibular or maxillary bone, depending on extent of antemortem data)
- Usually requires radiographic equipment
- Requires expertise in dental comparison

Medical/Radiographic identification – in some cases, an individual may have a medical device; a unique anatomic deformity, healed fracture, or anthropological findings; or artifacts of previous medical intervention that allow positive identification

Advantages

- Relatively rapid if antemortem documentation can be found

- Surviving family members likely to know where a loved one had major surgery
- Some medical prostheses may survive conditions well beyond those tolerable by human tissue

Disadvantages

- Requires radiographic equipment
- Fairly uncommon in the population at large

DNA Identification

Advantages

- Can be used on any human remains from which viable DNA can be recovered
- Can reassociate fragmented remains that lack fingers or dentition
- Antemortem specimens available from sources ranging from a hairbrush or toothbrush to paraffin-embedded tissue from a remote surgical procedure
- If an antemortem specimen is not readily available, family reference specimens may be used

Disadvantages

- Time delay
- Requires sophisticated laboratory and highly trained technologists
- Cost

Identification issues in a mass disaster

(1) Lack of visually identifiable remains
(2) Disassociated remains
(3) Commingled remains
(4) Open versus closed population of victims

Additional issues in a terrorist attack:

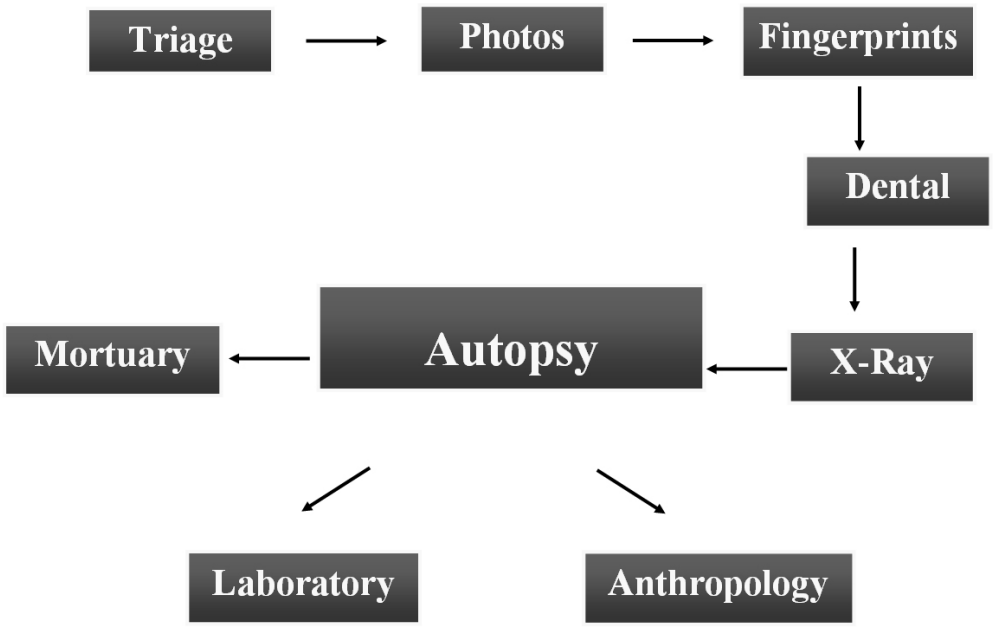
(1) *Separating the innocent from the murderous* – families will want (and deserve) to know that the remains being returned to them are those of their loved ones, and not of the terrorists who murdered them.
(2) *Identification of the terrorists* – the identification process may well yield conclusive findings as to the identity of the terrorists. This will be invaluable to law enforcement.
(3) *Recovery of critical evidence* – Only thorough examination of all the remains will ensure that critical evidence, no matter how small, is not overlooked.

(4) *Documentation of injuries* – May be critical for reconstruction of events, as well as ascertaining how long (if at all) some victims survived the initial attack (such as a crash) only to die in a post-crash event (like a fire or building collapse).
(5) *Protection of national security* – many of those in the Pentagon killed on 9/11/01 were in the intelligence community. Any documents, keys, electronic devices, or other items related to classified material had to be recovered.

The Disaster Plan

The exact order of operations in a mass disaster morgue is not as important as the concept *that the remains need to be processed, identified, examined, documented, and released in a systematic way* to ensure that identifications are accurate and evidence is collected and preserved

This diagram, and the comments that follow, are a conceptual model of the process used by the Armed Forces Medical Examiner after the 9/11/01 attack on the Pentagon. Every specimen should go through every station, no matter how briefly, and that station should document that the specimen was evaluated.



Triage/Safety
If the possibility of unexploded bombs, weapons, or other dangerous materials exists, the remains must be appropriately screened to ensure the safety of those in the morgue. Once this is accomplished, the anthropologist or pathologist assigned to the triage area examines every set of remains that comes through the door of the morgue. Aircraft parts and/or personal effects that are not associated with any human remains can be pulled aside and inventoried separately. Any human remains that are in the same bag, but are not physically connected, are separated into different bags, uniquely labeled, and assumed to be different individuals until proven otherwise.

Photography
All remains are photographed "as is" at this point. All accession number are double-checked.

Fingerprints
Antemortem fingerprints are received and organized. Postmortem fingerprints are obtained. Antemortem and postmortem prints are compared.

Dental
Antemortem dental charts and radiographs are received and organized. Postmortem dental charts are prepared and postmortem dental radiographs are obtained. Antemortem and postmortem dental materials are compared.

Radiology
All specimens are radiographed in their entirety. Radiographs may assist in recovery of critical aircraft parts; recovery of bomb parts, other explosive devices, or projectiles; reconstruction of injury patterns; and identification of medical devices or unique anatomic features for identification.

Autopsy/DNA
All specimens get a complete "autopsy" to assess injury, confirm natural diseases, recover any foreign material, separate personal effects, assure photographic documentation and narrative documentation of findings, etc. DNA is easily collected at this point, although a separate DNA station in the disaster plan is also workable. A separate DNA station earlier in the process may be quite useful to the laboratory if autopsies are delayed due to workload. If someone other than the autopsying pathologist collects DNA, it is important to note the incision used for

DNA collection on a body diagram; otherwise, the autopsy pathologist could misinterpret that incision as an antemortem injury. If a DNA technologist can be spared for the morgue, s/he may be invaluable in helping select the specimens most likely to yield useable DNA.

Anthropology
Anthropology need not be a separate section from pathology, but can be integrated directly with pathology. At the Pentagon morgue, many of the specimens spanned the "grey area" between pathology and anthropology. Having these two disciplines work side-by-side at the autopsy table was far more efficient that having them examine specimens separately.

Laboratory
Specimens are collected at autopsy for toxicologic testing. Carbon monoxide testing may be critically important in making a distinction as to whether a victim was killed instantly, or survived for some period of time before being overcome by smoke.

Mortuary
Here, remains are stored until identifications are made. As reassociations are made, more and more specimens become linked to the same name and can be stored together until such time as release to the family occurs.

Things to consider . . . . .

Staff morale and welfare cannot be emphasized enough. In a mass disaster setting, an emotional toll is taken on every member of the team whether they realize it or night. People need an opportunity to eat, sleep, do something "normal," and see the sun shining.

Take care of yourself. If you are a member of the team, make sure you get enough sleep, food, and hydration. It is far too easy in these events to ignore your own health. Don't try to be a hero. No one can work 24 hours a day.

Get help if you need it. Critical incident specialists, mental health professionals, and religious personnel are invaluable in this regard.

Remember that identification is a team approach. Even though the medical examiner or coroner is responsible for the overall morgue operation, and (ultimately) the validity of the identifications, s/he can only accomplish that through the talent and the experience of the highly skilled personnel working with him/her.

Keep families apprised of progress – they have a right to know what's going on. However, don't make promises on a timeline.

Is scientific identification better than nonscientific identification? In general, the answer is yes, but there may be situations (small numbers, intact bodies, distinctive marks or personal effects, closed population of victims, independent nonscientific methods converging on the same name, etc.) where nonscientific identification is adequate. Ultimately, this is a call the responsible medical examiner/coroner has to make, and it may be influenced by time and resource constraints.

VICTIMS OF AMERICAN AIRLINES FLIGHT 77 AND THE PENTAGON

Paul Wesley Ambrose, AA Flight 77
Craig S. Amundson, Pentagon
Melissa Rose Barnes, Pentagon
Max Beilke, Pentagon
Yemen Betru, AA Flight 77
Kris Romeo Bishundat, Pentagon
Carrie Blagburn, Pentagon
Canfield D. Boone, Pentagon
Mary Jane Booth, AA Flight 77
Donna Bowen, Pentagon
Allen Boyle, Pentagon
Bernard Brown, AA Flight 77
Christopher Lee Burford, Pentagon
Charles Burlingame, AA Flight 77
Daniel Martin Caballero, Pentagon
Jose Orlando Calderon, Pentagon
Suzanne Calley, AA Flight 77
Angelene C. Carter, Pentagon
Sharon S. Carver, Pentagon
William Caswell, AA Flight 77
John Chada, Pentagon
Rosemary Chapa, Pentagon
David Charlebois, AA Flight 77
Sarah M. Clark, AA Flight 77
Julian Cooper, Pentagon
Asia Cottom, AA Flight 77
Eric Allen Cranford, Pentagon
Ada Davis, Pentagon
James Debeuneure, AA Flight 77
Gerald F. DeConto, Pentagon
Rodney Dickens, AA Flight 77
Jerry D. Dickerson, Pentagon
Eddie Dillard, AA Flight 77
Johnnie Doctor Jr., Pentagon
Cmdr. Robert Edward Dolan, Pentagon
William Howard Donovan Jr., Pentagon
Charles Droz, AA Flight 77
Patrick Dunn, Pentagon
Edward Thomas Earhart, Pentagon
Barbara G. Edwards, AA Flight 77
Robert Randolph Elseth, Pentagon
Charles S. Falkenberg, AA Flight 77
Dana Falkenberg, AA Flight 77
Zoe Falkenberg, AA Flight 77
Jamie Lynn Fallon, Pentagon
James Joe Ferguson, AA Flight 77
Amelia Fields, Pentagon
Gerald P. Fisher, Pentagon
Darlene 'Dee' Flagg, AA Flight 77
Wilson 'Bud' Flagg, AA Flight 77
Matthew Flocco, Pentagon
Sandra Foster, Pentagon
Richard Gabriel, AA Flight 77
Capt. Lawrence D. Getzfred, Pentagon
Cortz Ghee, Pentagon
Brenda C. Gibson, Pentagon
Ron Golinski, Pentagon
Ian J. Gray, AA Flight 77
Diane Hale-McKinzy, Pentagon
Stanley Hall, AA Flight 77
Carolyn Halmon, Pentagon
Michelle Heidenberger, AA Flight 77
Sheila Hein, Pentagon
Ronald John Hemenway, Pentagon
Maj. Wallace C. Hogan Jr., Pentagon
Jimmie Ira Holley, Pentagon
Angela Houtz, Pentagon
Brady Kay Howell, Pentagon
Peggie Hurt, Pentagon
Lt. Col. Stephen Neil Hyland Jr., Pentagon
Robert Hymel, Pentagon
Sgt. Maj. Lacey Ivory, Pentagon
Bryan C. Jack, AA Flight 77
Steven D. 'Jake' Jacoby, AA Flight 77
Lt. Col. Dennis Johnson, Pentagon
Judith Jones, Pentagon
Ann Judge, AA Flight 77
Brenda Kegler, Pentagon
Chandler Keller, AA Flight 77
Yvonne Kennedy, AA Flight 77
Norma Khan, AA Flight 77
Karen A. Kincaid, AA Flight 77
Michael 'Scott' Lamana, Pentagon
David Laychak, Pentagon
Dong C. Lee, AA Flight 77
Jennifer Lewis, AA Flight 77
Kenneth Lewis, AA Flight 77
Samantha Lightbourn-Allen, Pentagon
Stephen Vernon Long, Pentagon
James T. Lynch, Pentagon
Terence Michael Lynch, Pentagon
Nehamon Lyons IV, Pentagon
Shelley Marshall, Pentagon
Teresa Martin, Pentagon
Ada Mason, Pentagon
Dean Mattson, Pentagon

Lt. Gen. Timothy Maude, Pentagon
Robert Maxwell, Pentagon
Renee A. May, AA Flight 77
Molly McKenzie, Pentagon
Dora Menchaca, AA Flight 77
Patricia E. (Patti) Mickley, Pentagon
Maj. Ronald D. Milam, Pentagon
Gerard P. 'Jerry' Moran, Pentagon
Odessa V. Morris, Pentagon
Brian Anthony Moss, Pentagon
Teddington Hamm Moy, Pentagon
Patrick Jude Murphy, Pentagon
Christopher C. Newton, AA Flight 77
Khang Nguyen, Pentagon
Michael Allen Noeth, Pentagon
Barbara K. Olson, AA Flight 77
Ruben Ornedo, AA Flight 77
Diana Padro, Pentagon
Chin Sun Pak, Pentagon
Jonas Martin Panik, Pentagon
Clifford Patterson, Pentagon
Robert Penniger, AA Flight 77
Robert R. Ploger III, AA Flight 77
Zandra Cooper Ploger, AA Flight 77
Lt. J.G. Darin H. Pontell, Pentagon
Scott Powell, Pentagon
Jack Punches, Pentagon
Joseph John Pycior Jr., Pentagon
Lisa Raines, AA Flight 77
Deborah A. Ramsaur, Pentagon
Rhonda Sue Ridge Rasmussen, Pentagon
Marsha D. Ratchford, Pentagon
Martha Reszke, Pentagon
Todd Reuben, AA Flight 77
Cecelia E. Richard, Pentagon
Edward Veld Rowenhorst, Pentagon
Judy Rowlett, Pentagon
Robert E. Russell, Pentagon
William Ruth, Pentagon
Charles E. Sabin, Pentagon
Marjorie C. Salamone, Pentagon
John Sammartino, AA Flight 77
Lt. Col. Dave Scales, Pentagon
Cmdr. Robert A. Schlegel, Pentagon
Janice M. Scott, Pentagon
Michael L. Selves, Pentagon
Marian H. Serva, Pentagon
Cmdr. Daniel F. Shanower, Pentagon
Antionette Sherman, Pentagon
Diane Simmons, AA Flight 77
Don Simmons, Pentagon
George Simmons, AA Flight 77
Cheryle Sincock, Pentagon
Gregg Harold Smallwood, Pentagon
Lt. Col. Gary Smith, Pentagon
Mari-Rae Sopper, AA Flight 77
Robert Speisman, AA Flight 77
Pat Statz, Pentagon
Edna L. Stephens, Pentagon
Norma Lang Steuerle, AA Flight 77
Sgt. Maj. Larry Strickland, Pentagon
Hilda E. Taylor, AA Flight 77
Kip Paul Taylor, Pentagon
Leonard Taylor, AA Flight 77
Sandra Taylor, Pentagon
Sandra D. Teague, AA Flight 77
Karl W. Teepe, Pentagon
Sgt. Tamara Thurman, Pentagon
Otis Vincent Tolbert, Pentagon
Willie Q. Troy, Pentagon
Lt. Cmdr. Ronald J. Vauk, Pentagon
Karen J. Wagner, Pentagon
Meta Waller, Pentagon
Sandra White, Pentagon
Staff Sgt. Maudlyn White, Pentagon
Leslie A. Whittington, AA Flight 77
Ernest M. Willcher, Pentagon
David L. Williams, Pentagon
Maj. Dwayne Williams, Pentagon
Marvin Roger Woods, Pentagon
John D. Yamnicky Sr., AA Flight 77
Vicki Yancey, AA Flight 77
Shuyin Yang, AA Flight 77
Kevin Wayne Yokum, Pentagon
Donald McArthur Young, Pentagon
Edmond Young, Pentagon
Lisa Young, Pentagon
Yuguang Zheng, AA Flight 77