*Brad Randall,*[1] *M.D.*

# Body Retrieval and Morgue Operation at the Crash of United Flight 232

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**ABSTRACT:** On 19 July 1989, United Airlines Flight 232, a wide-bodied DC-10, crash-landed in Sioux City, Iowa, ultimately resulting in 112 deaths. By using the first several hours after the crash to preplan carefully and to walk through the entire body recovery and morgue procedure mentally, the disaster management team was able to process the fatalities from Flight 232 expeditiously. The team also prepared a rigid system of data management for the morgue, which allowed the staff to collate and process large volumes of information without significant error or mismatched records.

**KEYWORDS:** pathology and biology, human identification, body recovery procedures, mass disasters, airline disasters, morgue operation

On 19 July 1989, United Airlines Flight 232, a wide-bodied DC-10, crashed during an attempted landing at the Sioux Gateway Airport in Sioux City, Iowa. One-hundred and twelve of the 296 passengers on board ultimately died from the accident: 101 at or within a few minutes of impact, 10 within a few days of the accident, and one several weeks later.

This paper is not intended to be an exhaustive treatise on the management of aviation accidents in general or Flight 232 in particular. Nor does the author intend to describe in detail the identification process or the dental and autopsy findings (both have been presented at the 1990 Annual Meeting of the American Academy of Forensic Sciences in Cincinnati, Ohio, and undoubtedly will be published separately at a later time). The suggestions and recommendations of others who have faced a large aviation accident in the past were invaluable. I hope, in turn, that the following observations and hints may be of some benefit to others facing the management of a mass disaster situation.

## Planning

Although three to four hours of daylight remained by the time all of the survivors had been evacuated from the crash site, the disaster management team did not initiate body retrieval until the following day. The team was simply not ready to begin immediately picking up and processing bodies without a well-thought-out plan. The ensuing evening hours were used planning, in as much detail as possible, the body recovery and morgue

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[1]Forensic pathologist, Laboratory of Clinical Medicine, and associate professor, Department of Laboratory Medicine, University of South Dakota School of Medicine, Sioux Falls, SD.

operation. We attempted to walk through the entire operation mentally. By following this procedure, we identified not only the large-ticket items that would be needed, such as an X-ray machine, but also the equally important smaller necessities. As a group, we constructed a mental working plan in as orderly and sequential a fashion as possible. This procedure identified the need for many mundane items, such as rags, tables (with plastic covers), miscellaneous dental and autopsy supplies, and gurneys (with lockable wheels). At this time, we also decided how information would be generated, how it would flow, and how it would be stored in the morgue. Equally important was the task of developing a list of necessary office supplies and word-processing equipment. In addition, a good heavy-duty photocopier and a FAX machine ultimately proved invaluable. Crucial to the planning stage was identifying individuals who could provide the supplies needed and determine what resources were available. Every hour spent in initial planning paid back handsomely, producing a relatively trouble-free morgue operation.

## Body Recovery

From descriptions of previous disasters, the disaster management team knew that the ability to pinpoint body positions at a crash site later could be instrumental in both the identification of bodies and an understanding of the crash mechanics. Conventional wisdom suggested constructing a traditional grid system to locate the bodies (Fig. 1, *top*) [*1–3*]. Although workable in a relatively small, compact crash site, the traditional grid was not applicable to a crash site which was over 1½ km long and several hundred metres wide. A former highway patrol officer suggested that we use instead a linear reference line and pinpoint each body by its distance from a reference point and its perpendicular distance from the reference line (Fig. 1, *bottom*).

Conventional wisdom also suggested that the bodies be marked with labeled stakes [*1–3*]. Many of the bodies from Flight 232, however, were scattered on the runway surface (Fig. 2), precluding the driving of wooden stakes. The patrol officer again came to our

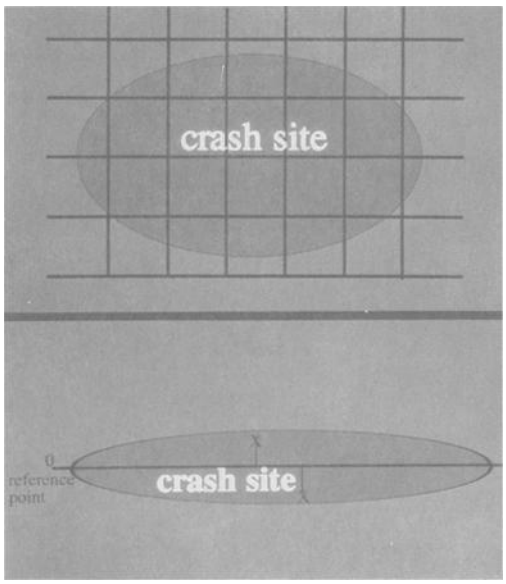


FIG. 1—*Gridding systems for plotting body positions at a crash site:* (top) *a traditional rectangular grid;* (bottom) *the linear plotting system used in investigation of Flight 232.*

FIG. 2—*Bodies scattered on the concrete runway, precluding the driving of labeled stakes to mark the body position.*

aid and suggested that body locations could be marked with spray paint of the type used by highway crews (Fig. 3). The assigned body number was also painted directly on the corresponding body bag as an indelible identification. By using paint (ultimately three cases of cans), relatively permanent markers were produced without the risk of loss or of mismatching inherent in the use of tags.

Body recovery was initiated by dividing the crash site into distinct zones and assigning a recovery squad to each zone. Each squad consisted of a pathologist/leader, a scribe who recorded the coordinates of the body plus other observations suggested by the pathologist, a photographer, and two or more helpers. Each zone was walked shoulder to shoulder, with the addition of many more helpers in the areas of standing corn or soybeans. Once marked, the bodies were free to be removed to the morgue's refrigerated trucks.

## Morgue Operation

As in many other aviation accidents, a large open airplane hangar served as the morgue. The disaster management team elected to designate specific areas within the morgue for specific operations (for example, initial processing, X-raying, dental examination, fingerprinting, autopsy, and embalming) and then move the bodies on gurneys individually from area to area. A flow diagram was developed (Fig. 4) and strictly adhered to. As a new touch to this format, the areas within the morgue were separated by 5 to 6-ft (1.5 to 1.8-m)-high mobile partitions (Fig. 5). The partitions successfully compartmentalized the morgue and helped to prevent the work of one area from interfering with that of another.

Our greatest operational concern within the morgue was the loss or misplacement of information. To avoid this problem, a Red Cross volunteer (called a "tracker") was assigned to each body as it flowed through the morgue. The information folder carried by the tracker, or kept at the central repository when the body was not on the floor, was

FIG. 3—*Body positions marked with spray paint on the runway surface (the inset illustrates upside-down operation of a spray paint can).*

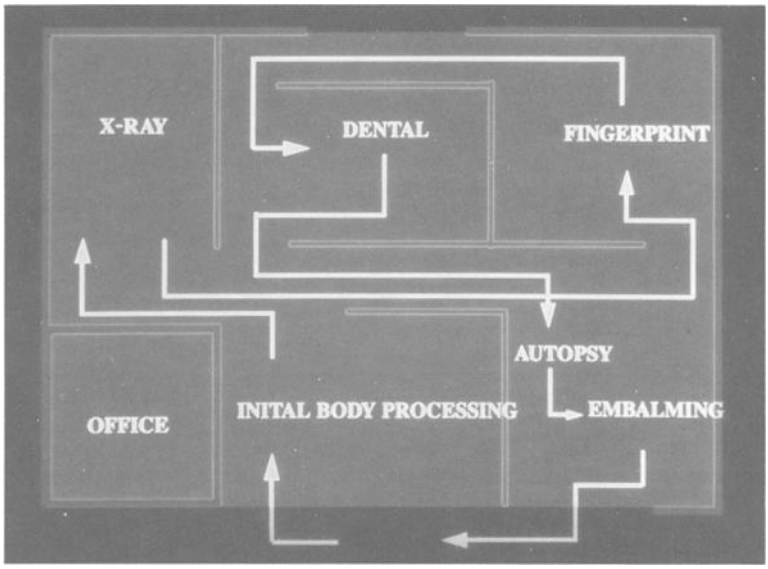


FIG. 4 *Diagram of the body flow through the morgue.*

considered inviolate. Whenever possible, data requests were filled by copying original data rather than by releasing original documents.

The bodies stored on the refrigerated trucks were also tightly controlled with a sign-in/sign-out sheet posted on each truck. The bodies were moved in a fixed pattern between three sets of segregated trailers, from trailers for bodies awaiting initial processing, to trailers for bodies having completed the morgue processing, to trailers with positively identified bodies only. Removal of bodies from this last set of trailers was controlled by one individual, and a body was released only after successful completion of an elaborate set of checklist release documents. The problems of misplaced data or mistaken or premature body release did not occur.

To facilitate the control of data during the identification process, the team elected to split the administration of the morgue into two distinct positions. The senior position was filled by a pathologist, who assumed ultimate responsibility for the morgue operation. His primary duties were to coordinate the operation of the separate areas within the morgue, arbitrate disputes, and serve as liaison for the resolution of equipment and supply problems. We found that the best way to meet these goals was for the pathologist/morgue director to be highly visible and to roam freely and often throughout the morgue. The state medical examiner, who assumed overall authority, did not fill the position of morgue director, which thereby freed him to attend to the details of the entire operation.

The second administrator coordinated the clerical duties within the morgue. This administrator was responsible for ensuring that all of the information generated within the morgue was properly collected and stored. The office/clerical staff and volunteers also were part of this administrator's responsibilities. Since this position was essentially that of an office manager, the management team felt that this position could be best filled by a lay businessperson. The second administrator was a volunteer who was an office manager for a United States senator's local service office. Our assumption that anyone who could manage the flow of information through a U.S. government office could handle the morgue data process proved to be correct.

FIG. 5—*Morgue operation area, showing the partitions separating the different work stations diagrammed in Fig. 4.*

## Security

Security did pose some problems during the initial morgue operation. The management team had assumed that, since the morgue facility was in a military hangar, the U.S. National Guard would automatically fulfill our security needs. Although the press and the curious public were well contained, when the time came to start the operation, the morgue was filled with construction workers, curious onlookers (many of them guardsmen), and occasional public officials. The overload of people did result in considerable confusion and delay during the first day of operation. In retrospect, prior to initiating any morgue activity, we should have cleared the morgue, issued passes and only admitted essential personnel. This procedure was followed on the second and subsequent days, and it worked well.

## Conclusions

The most valuable lesson learned during this disaster operation was to delay early body recovery and morgue processing until the operation format and supplies were in place. Although the experience of others from previous aviation accidents was invaluable, a multidisciplinary preplanning approach, tailor-made for this specific situation worked far better than blindly adhering to standard procedures advocated by others as a result of their experience in other disasters. Tight control over the morgue data, although initially somewhat cumbersome, ultimately saved time and ensured against loss of information or misidentification.

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Address requests for reprints or additional information to
Brad Randall, M.D.
Associate Professor
Department of Laboratory Medicine
University of South Dakota School of Medicine
1212 S. Euclid Ave.
Sioux Falls, SD 57105