ning our incident via the engineers, which made it sporadic, disjointed. We had to stop, regroup, and focus again on the direction we were taking. Our objectives and the engineering reports would be one of those action methods required to continue the objective. The problem finally would be put to rest on Day Five.

Day Four

With G12 secure and widow makers removed, we committed considerable manpower to debris removal and search of the westernmost section of the Pile, from the front to the Christmas Tree, between G12 and F12. Hone and his crews continued the heavy work in the Pit. More and more bodies were coming from this area. Additional shoring was erected on the first floor, columns 18 to 16 — now it really looked like a forest. And we continued removing the fall hazards along F18, 16, and 14.

Several crews entered the east-side "basement." This area was very hard-hit, and there were many difficult entombments. Eight to 10 bodies were recovered from this location. By the end of the day, the body count was up to 78.

Up to this point, the fire department had rotated through several rescue commanders and FEMA had several engineers and several task forces — in short, a lot of people doing a lot of different things that were not very consistent or standardized. Oklahoma City Chief Gary Marrs was beginning to feel this, too. Late on Day Four, the chief was making one of his many stops during the day to see how things were going, and he didn't like the progress. Just before midnight he called a meeting of command-level personnel and engineers to set things straight. He announced that the constant changing of the operational plan would stop. He made it quite clear that he was in charge and set some simple ground rules: Anything that had to do with the building, in both a technical way or in the way of rescue or recovery, would go through me. Anything of a more global operational nature, such as policy, would go through Rescue Command. A lead engineer, who would speak for all the engineers after a consensus was reached, would be designated. And he wanted a plan for dealing with the Mother Slab by 7 a.m. the following morning. He asked if there were any questions. There were none.

Day Five

I arrived about 5:30 a.m., parked in my usual place, and walked in. Everyone in Rescue Command was gone. Even the IST Command was empty. I got nervous. Operations were at a standstill. Where was everyone? I walked out front. Everyone was outside across the street. People yelled at me to come over. I went over and was told they were cutting down the Mother Slab with a cutting torch. I said, "They're WHAT?" By this time, they had a team on the ninth floor with a cutting torch rigged up to reach out and cut it loose. I asked Downey, "What are they doing?" He said he didn't know — this operation already was in progress when he arrived. He said they had one more piece of rebar to cut, and it would come down. I did not like the idea of 35,000 pounds of slab falling to the Bowl and who knows where from there. To put this in perspective, the wrecking ball we had on-site weighed 3,500 pounds.

I told Downey if the slab didn't fall after this cut, stop the activity. The rebar was cut, and Mother swung to the west, hitting Column E22, then pendulumed back — and then stopped. Downey radioed the team to stop the action. We all had a long talk over the Mother Slab again.

We decided to call in a demolition expert from Tulsa — thinking we might be able to blow off small pieces of it and solve the problem. The demolitions expert arrived and evaluated it. He suggested that we "strap it to the south wall and leave it alone." Downey and I only looked at each other, eyebrows raised.

Meanwhile, the Pit was going well. Hone was really moving the debris. The night shift with Jim Lambert, engineer for OCFD Special Operations, came up with the idea of removing the "South Side Wall" (the wall of the Pit that used to be the second floor, which fell at a 45-degree angle) and opening up a passageway through the wall between the garage and west wall of the main building so as to bring the Bobcats (mini front-end loaders) into the Pit. This eliminated considerable hand-hauling of debris and greatly sped up the dismantling of the Pit. Our search units were quickly following upper-floor (fall hazards and upper-floor clearing) personnel across Column Line F, toward Column F16. All shoring was, for the most part, complete and solid.

Finally, near the end of Day Five, the Mother Slab was tied back. Firefighters drilled holes through the slab, steel cables were inserted through and secured to it, and it was tied back to the main stairwell, which was structurally sound. I was pleased with this solution, but it still didn't end the talk about Mother.

Days Six, Seven, and Eight

Day Six began much like the one before. We began it, as with those previous, by searching "blind" — we did not have critical information about occupants' last known locations so that we could begin to pinpoint where they might have ended up after the collapse. We were digging, generally, only in areas where we had previously found victims. We made many finds this way, but it wasn't until the afternoon of Day Six that we had some real direction.

Charles "Chuck" Smith, a medical examiner from Louisiana, and Todd Ellis, from Texas, both from FEMA's D-MORT Team, came to us with information they had gathered over the past several days: Murrah Building blueprints with a list of occupants and last known locations. We had been requesting this type of critical information since Day One. In fact, one of the first questions Downey asked me was, "How many people were there and where were they?" It was initially believed that there were 650 occupants at the time of the explosion; exhaustive research confirmed the true number to be about 350. We began to study this information so we could streamline our operations.

About that time, Hone's crews radioed that they had just uncovered a child. The location of the child did not match that of the area in which the children from the day-care center should have been. I went to the scene and studied it very carefully. The child was found against the ground floor with no debris underneath it. Referring to our newly gained information, we believed this child to be number 30 on the medical examiner's list, and that the child should have been a three-year-old. We also realized from the map that if the child was indeed number 30, it was a considerable distance from its original location designated on our newly acquired map. If our information was correct, the child was in the Social Security Office waiting room, at the north of the structure between Columns G22 and 20. Its body had been uncovered near Column E22. I closely examined the child and — based on a mental comparison with my own child, who at the time was approaching three years of age — determined that the child appeared to be a three-year-old. However, the consensus among the group working at that time was that it was a six-year-old. I didn't agree and went home that day with the feeling it was a three-year-old. I left the site that day feeling optimistic. For the first time, I felt there might be a system here. When I arrived home late that night, I went to my daughter's crib and felt her arm. It reinforced my belief that the child found that afternoon was a three-year-old. The next morning, I had hope that there was a way out of this. Then one of the medical examiner's liaisons (not the one I had been working with) told me it was not the child we had been looking for but rather a six-year-old. I was emotionally destroyed. I thought we had found the system that would drive us through the rest of the recovery — that for once we had a reason to go to certain areas, not just dig and hope for good results. A few hours later, Smith returned and told us the child was the three-year-old; it was number 30. I was ecstatic. Sure enough, very close to the proximity of number 30, we began to find all the other victims expected to be in that vicinity. It was a relief beyond explanation.

We knew from reading the building that in the collapse the Social Security Office waiting room had become part of the Christmas Tree between Columns F22 and F18. This was a particularly dangerous area for search personnel because of the way the debris leaned into those columns, and we already felt we would not be able to search it at all. All along, I dreaded having to explain to my chief that we would have to leave a large number of people in that pile. This new information, however, indicated that the people in that area — possibly more than 18 — had been blown some 50 feet from their original positions. Now we knew where to begin looking for them. We developed a definitive, methodical plan for accessing and working in these areas; it included four inspections between the various operational steps.

Most of the caving and heavy void tunneling was done by Day Six. Between Day Six and Day Eight, interior operations personnel knocked the Pit and Cave to pieces. By Day Seven, the fall hazards crews were cleaning off the upper levels between Columns F16 and F22, and the search teams on the Pile were following behind them.

On Day Eight, fall hazard operations were extended beyond Column F22 to around the entire perimeter of the Bowl. A large section of the Pile, between Columns 16 and 12 in the front of the building, had been cleared, and we committed heavy manpower to the Pile just west of the Christmas Tree. Operations in the Pit were nearly over.

We were finding many victims below and beyond where we found number 30, just east of the Pit. Before it was over, we would find 67 victims there. It took from four to six hours to remove the average victim. Some recoveries obviously were quicker. Other victims could

be seen and touched for days but couldn't be extracted because of the massive weight of the materials in which they were entombed. By the end of Day Eight, the body count was up to 98.

Days Nine, Ten and Eleven

Every day, the building was getting better, stronger — which meant it was safer. We were becoming more methodical. We were almost settling into a routine. It seemed at times we were working on a construction site — and then the smell would bring us back to reality.

Between Day Nine and Day 11, we spent many manhours on the Pile. The front of the Pile across 16G-F to 20G-F was well on its way to being cleared, and by Day 11 search and rescue teams swung east almost into the Bowl. The only upper-floor debris removal left was in the Bowl area. We were progressing quickly now. As we entered this stage of the incident, we began to talk about safety more — but in a different way. I remember Ghilarducci emphasizing that we had gone too far through this incident, exposed to all these hazards, to make a stupid mistake now just for the sake of speedily bringing it to an end. The more I thought about it, the more the idea of "We've dodged the bullet and have been very lucky. Will the luck run out?" came to mind. We had to recommit ourselves to intelligent decision making at every level.

The Final Days

Chief Marrs announced on Day 12 that we were entering the recovery phase. Most of the USAR personnel now had been demobilized. By now we were down to only about 2,000 square feet left to search. Special operations personnel, working in 12-hour (6 a.m.-6 p.m.) shifts, began recovery work. We would move in from the east Pile into the Bowl. Heavy equipment would be used where it could be; manpower would be used in the smaller, closer areas where the equipment wouldn't fit. We went to a 12-hour workday because the team needed to know the operation was coming to an end. Everyone was tired and needed to get more rest and avoid working nights, when lights and mental stress seemed to take their toll.

We still had not tackled the Christmas Tree area — the extreme hazards in this area had not changed. By Day 15, we had pushed into the area of highest victim concentration, just east of the Pit, and recovered 18 more bodies. On Day 16, May 4, approximately 18 to 20 victims were still in the building — three of them were infants in the day-care toddler area. This was one of the areas closest to the blast site and had been near the bottom of the pancake collapse. I remember pulling a small stick of wood out of this area halfway between Columns G24 and F24, in the east pile "bite" leading into the Bowl. It appeared to be a crib slat. I felt this was where we were going to spend most of our time.

I was prepared for the possibility that as many as 12 to 15 people might not be recoverable. As Day 16 wore on, however, we located numerous victims. There were five victims left — including the three infants. At approximately 5:30 p.m., I brought the special operations teams to the street and asked if they wanted to continue working past the shift's end, as some had suggested, or preferred to come back in the morning. They unanimously agreed to stay.

Chief Marrs approved extending the shift and directed me to develop break schedules. The men went back to work. Within a few hours, we backed out the heavy equipment and brought in two OCPD search canines. We used these dogs because we were moving to a section of the collapse that was very tightly pancaked and hazardous to personnel. We wanted to confirm that victims were there. The dogs had good hits all over the area where I had found the crib slat. One of the dog handlers stated that his dog thought there were "some small ones." I asked him how he knew that. He said it was just "the way Gunny was acting."

At approximately 8:30, we dug to an area in which we found more crib parts. A few minutes after that, the first infant was found. Within an hour, we recovered the other two. I will always remember the expression on an officer's face as he picked up one of the infants, cradled it, then calmly asked for a body bag — it was a face of indescribable tenderness and grief at the same time.

By now, everyone was digging and working — even the engineers. Chief Marrs had been with us for most of the day and now was constantly with the personnel. We were all ready for this operation to conclude.

We worked directly in line with Column 24, digging and backing out of the building. I knew it would be over very shortly; we were down to two remaining victims. I never really thought we would get the number of unrecoverable victims into single digits. We knew the locations of the last two victims from the dogs and the maps. It was nearing 10 p.m., and we were looking

seriously at how close we could dig to Column F22. Even though this column was shored with horizontal bracing, its base was piled high with debris and its integrity unknown. We had left it alone for the entire incident — now we were going to mess with it.

The Final Search

Engineer John Osteraas and I consulted extensively about the safety of digging closer to this column. He felt we could dig very close, even possibly recover the victims. The problem was that for the past 10 days we were being told it was unsafe to dig in that area. I believed the engineer but didn't think I could get the trackhoe operator to dig much closer.

It was now about 10:30. I asked the backhoe operator if he would mind making some probing digs around the column if we put watches on the column and on his bucket in the hole. He agreed. I cleared the building of all personnel with the exception of the spotters. The trackhoe operator chose Lieutenant Mark Mollman and me as the spotters.

I went to Column F22; Mollman went into the hole. At his request, an engineer came to stand beside me. Everyone else was out of the building. We dug a few minutes at the base of 22. One of the pulls of the bucket almost pulled my feet out from under me. I had one hand on the column, and I felt a lot of vibration in it. I didn't know how much rebar that we couldn't see was wrapped around the column. I stopped the backhoe operator, walked around to his cab, and asked him how that felt. He said it was very tight. I thanked him for staying with us and told him it would be fine to go ahead and back out. I then reported to Chief Marrs that I believed we had gone about as far as we could. He thanked me and declared that the fire department operation had concluded. It was now 11:45 p.m. We shut down the equipment and lights, walked over to the makeshift memorial, and listened to a few brief closing words from the chief and chaplain. It was over.

Lessons Learned and Reinforced

- Size-up, size-up, size-up. If the rescue operations officer stops to assist victims (especially during the initial stage of the incident), you're not gathering information — and you are going to need all the information you can get. Your information may be the only information available for a while. Take notes, slow down — write it down.
- Hold more resources in staging. This will allow better control and more efficient deployment of resources. Bring them out when needed.
- Clarify the lines of authority. Operationally, make a single point to get a grasp on knowing what the right and left hands are doing, want to do, and plan to do. Every commander had a different way of wanting to handle the site, based on knowledge and experience.
- Assign jobs, delegate authority. Provide a better span of control at the lower levels. There were too many jobs to be done and too few experienced people to do them.
- Site control. Keep the best-intended at a safe distance and gain control of the site. For the first few hours, the public and other response agencies had so much access to the building that they caused many problems with falling debris. They had no safety equipment and in general increased the opportunity for injury — to say nothing of increasing the responsibilities of the fire department.
- Special operations chief — goals and objectives. Effectively communicating the direction of the tactical objectives allows team leaders to match their tactical objectives to the operations objectives. A breakdown in communications occurred when commands, work shifts, and task forces changed.
- Escalate slowly. This allows tactical objectives, equipment, and manpower to equalize and better fit each other. Things seemed to be out of sync — too much work for too few people without the needed equipment, or the other way around.
- Never stop gathering information. Keep all lines of communication open. You may get some information and not know its worth until a later time. I was lucky. People were everywhere gathering information in the hope that some of it would be useful. Some was.
- Put high-hazard and risk areas in writing. Keep all your notes in writing so everyone who comes behind you will have an idea of what has been classified as a hazard. People had to cover the same ground we did without the benefit of all the support.

- Keep all special operations people together. Keep your talented people together. They will feed off each other, and the learning curve will go up faster. The teams were broken up, scattering their skills. The learning curve flattened.
- Rotate special operations teams every 12 hours. This allows fewer chances to miscommunicate and promotes a steeper learning curve. With shorter shifts, teams spend more time off-site than on-site. There was too much rotation; the learning curve went flat.
- Write and post goals, objectives, actions. All task forces and shifts must have a clear understanding of operational tactics and the overall direction of the operation. Communicate the mission. Provide the status of each tactical objective.
- Control resources and communications. At an extended, large-scale incident, fire departments must work to ensure control of forward resources and adequate communications between branches, divisions, and groups.
- Follow SOPs. SOPs are designed to help you. Use them. Many problems were created because people felt there wasn't time to use them; you don't have time not to use them.
- Mutual aid. Bring in only what is needed — trained and skilled personnel. Too much help — much of it untrained help — was on such a small debris pile during the early stages.
- Set up a cache for special operations so there is no need to have to rely on anyone. When a task force would leave or go off duty, so would the equipment.
- CO problem. Extended use of gas-operated power tools caused a CO problem in the tight, confined spaces of the collapse. Explore your electric or pneumatic tool options for debris removal/extrication work. Monitor for CO buildup constantly and take corrective actions (move personnel out of space, use ventilation fans, etc.).
- Task assignments. Officers should carefully choose/assign personnel. The best tools in the world are ineffective in the hands of the wrong person.

Collapse Considerations

OCFD covered most of the "26 Collapse Considerations" (taught and practiced by City of New York (NY) Fire Department Battalion Chief Ray Downey) within the first few hours of the incident — though, admittedly, I was not formally aware of the 26 points during this response. These considerations and how they were accomplished follow:

1. Time: April 19, 1995, 9:02 a.m. weekday, work day, morning traffic.
2. Location: Downtown 5th Street between Robinson and Harvey, Alfred P. Murrah Federal Building, Oklahoma City. Heavy population.
3. Occupancy: Work day, federal employees approximate 360; private (day care).
4. Height and area: Nine floors, approximately 115 feet high. Main building approximately 150,000 square feet. Total area 320,000 square feet.
5. Construction: Steel-reinforced concrete.
6. Size of collapse area: 54,450 square feet of floor space collapsed into 7,000 square feet of rubble.
7. Victims (confirmed, what-ifs): 650 possible occupants, as per building management. More than 350 workers assigned to building on a daily basis. As few as 24 and as many as 58 live victims removed by rescuers in the first 1½ hours. [Editor's note: Though official sources cite the number of actual rescues from the building as being 58, several sources involved in the operation believe the number to be closer to 25.] More than 200 victims believed to be still in the collapse. Actions:
   - survey and reconnaissance of the entire area for trapped victims.
   - immediate rescue of victims on the surface of the rubble.
   - exploration of the voids and removal of the victims found there.
   - selected debris removal.

   These are four of the five collapse operational stages (the fifth is general debris removal).
8. Utilities (gas, water, electric): Oklahoma Gas and Electric, Oklahoma Natural Gas on scene, working within interagency command structure. (good relationship — Emergency Management Institute class).

9. Weather: Corporal Clint Greenwood (science officer/haz mat) monitoring weather, morning of Day Two.
10. Exposures: (N/A).
11. Fire Problem: 40 to 50 cars, three engine companies.
12. Traffic: Oklahoma City Police Department, Oklahoma County Sheriff.
13. Vibrations: sources: helicopters, wind, thunder, lightning, rescuers. Air vehicles not permitted near space. Monitor weather. Control rescuers.
14. Manpower: Oklahoma City Fire Department, mutual aid, military, later FEMA USAR Task Forces.
15. Communications: In the building, could have been better. Cell phones excellent.
16. Interagency operations: IC, Rescue Command, later MACC (Multi-Agency Command Center).
17. Medical needs: OCFD, EMSA, hospitals/medical personnel — handled quickly first hour.
18. Special equipment: Southwestern Bell, Oklahoma Gas and Electric, many donations.
19. Construction equipment (crane, payloader, etc.): Allied/Midwest Wrecking/Flintco, on scene. Allied on scene in 45 minutes.
20. Shoring materials: ICM/Home Depot.
21. Information updates: IC and Rescue Command.
22. Staging areas (manpower, equipment): established, OCFD IC.
23. R & R, relief of members: Rescue Command, Salvation Army, Red Cross.
24. Safety of members: Rescue operations chief, special operations team members.
25. Secondary collapse: Possible from initial size-up: east wall, east side "basement" from Bowl "kick out," third floor columns 18-22, second floor columns 16, 18-22, below Pit (the Cave), south side "sun shades" south wall behind Column E24, Column 12G, slides from the Christmas Tree.
26. Golden day-survival chance: All but three known live victims removed within 1 1/2 hours. Final known live victim removed within 12 hours (10:30 p.m.) All 267,396 square feet of the remaining building was searched and "cleared" of live victims by 8:30 p.m.: OCFD and mutual-aid departments.

After the incident, I second-guessed myself; but after many discussions with Downey; Jim Hone (division chief, Santa Monica (CA) Fire Department), Interior Operations; Mark Ghilarducci (deputy chief, Fire and Rescue Division, Special Operations, California Governor's Office of Emergency Services), USAR IST; and others and after going over these 26 considerations and the five phases of collapse, I have achieved greater peace of mind.

Structure Area Nicknames

As work progressed in every area of the unstable Alfred P. Murrah Federal Building and rescue workers began to operate in various areas of the structure, nicknames for building sectors began to pop up. The nicknames served as a quick reference to specific areas of the structure for the many teams operating within it around the clock. Under this informal system of assigning personnel, task force leaders of newly deployed teams were shown the locations of the appropriate "nicknamed" areas before they reported to the sector command for the team's assignment. Here are just a few.

- *The Forest*. This area was on the first floor from Column Line 16 to approximately 10 feet past Column Line 18, between E and F. The area contained 30 separate shores, necessitated by the broken and deformed spread beams and the concrete slab within that area. Many victims were trapped under the tremendous amount of debris within this area, which was the site of an extensive search for survivors after it had been stabilized. Since it was difficult to shore with the large amount of debris in the way, initial shoring consisted of installing pipe shores wherever possible. Major shoring was needed for the highly unstable second-floor slab, cracked in dozens of places, and the two supporting spread beams. The spread beam located on Column 18 between Columns E and F was directly west of "the Pit" area. A 15-foot-long section of the second-floor slab was still attached to this spread beam by reinforcing bars, collapsed in

supported lean-to fashion into the bottom of the Pit. Another section of the second floor, at 18 E-F directly south of the supported lean-to, was approximately 12 feet long and hanging in an unsupported lean-to fashion. This put a considerable strain on the spread beam that it was not designed to support and which itself was cracked and partially separated from the F column.

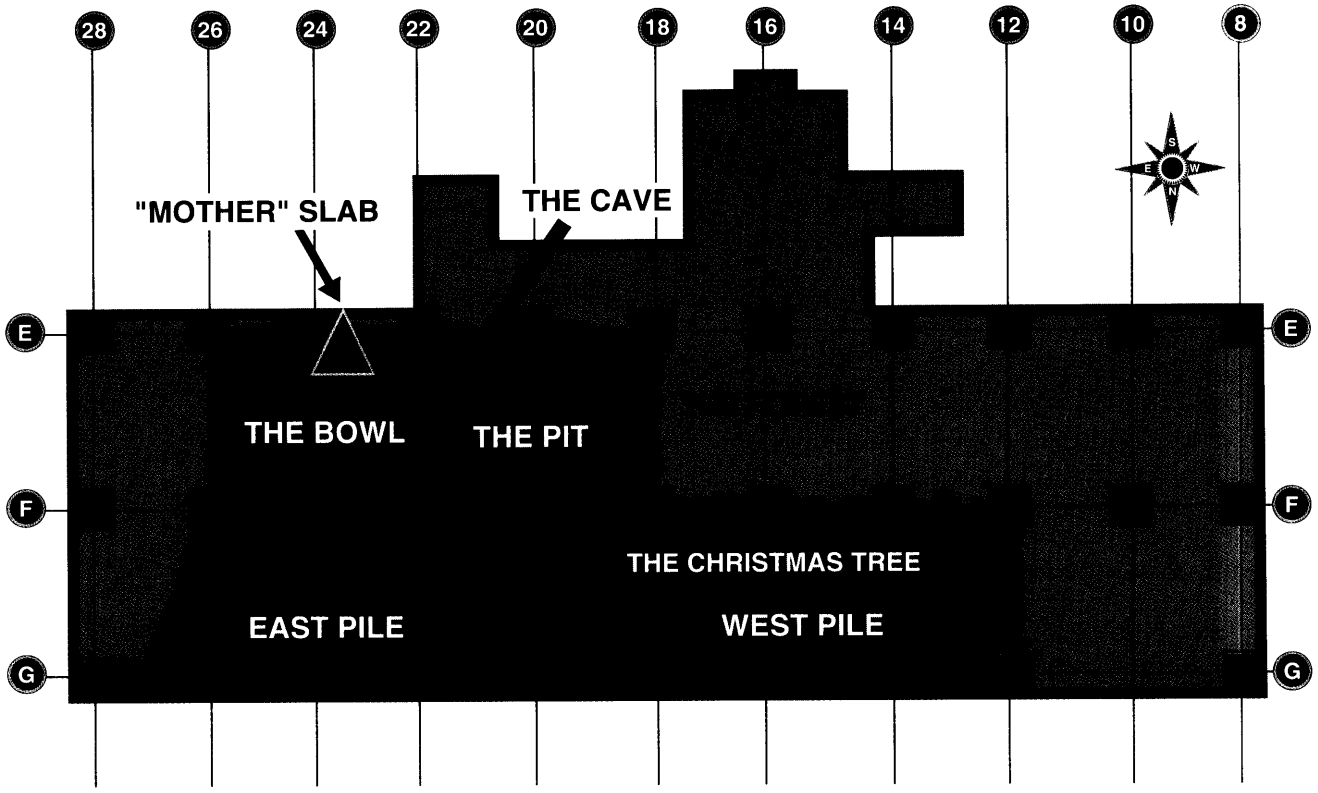
- *The Cave.* An area at the south section of the collapse near the stairs, under the collapse of the two floors that formed the Pit. The only initial access to this area was from underneath a collapsed spread beam, which was broken and separated from the supporting column. Numerous people were trapped and buried in this area. Extensive efforts were expended in this immediate area during the initial stages of the rescue. Operations continued here for several days after the initial explosion. Two stories of debris rubble were piled on top of this area. A large section of the second-floor slab held intact created this void, which became known as "the Cave." As rescue workers began to enter the void area attempting to rescue trapped occupants, extensive void shoring and box cribbing had to be erected.

- *The Slab from Hell or The Mother Slab.* A large section of the roof was hanging and lying in the gap leaning on the ninth and eighth floors. Structural engineers on-site estimated that this slab weighed from 30,000 to 35,000 pounds. The engineers arrived at this conclusion by estimating the size of the slab in square feet and multiplying that number by the thickness of the slab. The number of 150 pounds per square foot was used to approximate the weight of each square foot of concrete; this is an average number used for general calculations. The slab itself was checked out foot by foot from a safe distance with a theodolite (a precision instrument used in surveying, which consists of a sighting device equipped with a telescope, a leveling device, and an accurately graduated horizontal circle; a surveyor's transit is a type of theodolite). The cracks and damage were documented, and the slab was under a constant vigil. Several witness marks were put on the slab for quick recognition of any movement. From the start of operations, this slab was part of the safety discussion; suggestions for removing it, cutting it loose, and dismantling it piece by piece were addressed. It was finally decided that the best course of action under the circumstances would be to tie the slab off to the structure with cables. Operations within the area stopped temporarily while cables were slung around and into the slab and then secured back into the building around several of the safer columns that were still intact. The slab remained a constant source of concern to the rescue workers throughout the operation. However, monitoring of the slab by engineers showed that it had not moved for the duration of the operation. The slab came down when the building was demolished. Even then, as it fell with the structure, it stayed in one piece until it came in contact with the bottom of the pile.

- *The Pit.* Numerous victims were removed from the tremendous amount of debris cleared from this area, which encompassed the section from Column Line E to F and Columns 18 to 22. Within this section, the second floor had collapsed onto the first floor, and debris from the upper floors near the Column 24 line also came to rest. The Cave was located in the rear of this area. The name "Pit" was chosen because the area contained debris piled approximately 10 feet high while outside the Pit area, where all the floors had collapsed, the debris pile was three stories high. This gave the impression that there was a hole ("pit") in the debris.

  Another problem arose in this section of the structure when the second floor collapsed and the third floor to the roof area above this section stayed intact. The large void area created by the missing second floor left the remaining Columns F20 to F22 freestanding. This situation created major anxiety for the structural engineers, who were concerned about the lateral stability of the columns where the second floor was missing and especially since a tremendous amount of debris was leaning against these unsupported columns, adding to the lateral strain. To help alleviate the strain, steel-pipe shoring, installed by contractors on the scene, was used to brace the unstable columns. The pipes were anchored to the columns in question and reached back to the E line of columns.

Figure Five: Nicknames



- *The Christmas Tree.* A large section of floor collapsed in unsupported lean-to fashion against Columns F14, 16, 18, and 20, three stories high. Its cracks and peaks, and the debris on it and around it, gave it its name. It was a very dangerous collapse area and was not removed. Fortunately for rescuers, no victims were buried in this area.

- *The Bowl.* The section spanned from Columns E22-26 to F22-26. The west section of the debris pile in the Bowl had a high concentration of victims. Just north of the Bowl, where Column F24 collapsed, also had a high victim concentration. The collapse of F24 caused the second floor to fall forward toward the front of the building, creating some unstable void areas. Nine floors of debris were piled almost up to the third-floor height. Several times, the debris shifted. This area was one of the most dangerous in the collapsed structure. In the rear section, several of the floor slabs came crashing down and angled toward the front of the building. All the other sections of broken floor slabs in the building angled toward the rear of the structure. While all of this was going on, the Mother Slab, pinned back with cables, was still hanging from the roof.

- *Australia.* One of the larger hanging slab sections, it received its name because the shape of the broken slab was said to resemble that of the continent of Australia. I did not see the resemblance, but who was I to argue? This large section of slab had to be broken up and dismantled in smaller pieces for safe removal.

- *The Basement.* This large area — the one-story east side extension — contained mostly offices. Technically it was on the first floor; there was no basement under the main building. The only access to this area was from a stairway on the east side of the exterior of the building that went down approximately six feet to the structure's entrance. Walking down the stairs gave the initial impression of going underground. The building was erected on a slight grade, the west

end of the structure was at street level; the east end was approximately six feet below grade. More than a dozen victims were removed from this section; quite a bit of debris — primarily office cubicles, file cabinets, desks, and office equipment — was in this area. The area's entire drop ceiling was destroyed and covered everything. Even though it wasn't heavy, it had to be cleared to gain access to the various office spaces.

- *Widow Makers.* Literally hundreds of pieces of broken concrete were hanging from the remaining structure — a result of the slabs' being destroyed by the blast. The pieces ranged in size from 12 inches x 12 inches to 20 feet x 20 feet. Most were roughly 4 feet x 4 feet and smaller. Many were being held up only by one or two pieces of rebar and swayed when the wind picked up, which happened on a continual basis. They had to be removed promptly as the wind picked up; their shifting and swinging caused them to loosen further and become even more hazardous. The name "widow makers" signified the potential for serious injury to rescuers if any of the floor-slab pieces should break loose and fall. These sections of concrete, a safety concern from the start of the operation, were removed during the first several days of the rescue operation.

EMS Response and Command

Fire Headquarters shook violently at 9:02 a.m. I looked up, and Special Operations Chief Mike Shannon was walking by my office. I asked, "What was that?" He replied, "I don't know, but I think we're gonna be needed." I ran out into the parking lot where my car was parked and looked to the east from the office. It looked as though four or five blocks in the middle of downtown were one big pillar of smoke. Mike Weatherly, a light-duty firefighter working on some projects in my office, and I responded down NW 5th Street. We could see thick black smoke billowing out from the area of 5th and Harvey. I parked my car at NW 5th and Hudson, one block west of the Alfred P. Murrah Federal Building.

As I reached the intersection of NW 5th and Harvey, I observed that a Command Post was being set up at NW 6th and Harvey. Debris was all over the streets, papers were coming down from the sky, and smoke was rolling out from the north side of 5th, filling the entire area. I could see fire on the north side for the entire block. Crews already were on the scene assisting the victims. Instead of entering the building, I proceeded to the Command Post so I could better coordinate the rescue effort with the medical transportation effort — many people were severely injured. Through the smoke, I could see the terrible destruction of the Murrah Building.

Establishing EMS Command

I reported to District Chief Robert McMahon, the IC, and asked if he wanted me to set up EMS Command. He said yes. I established EMS Command and assumed the position of commander of this branch within the ICS structure, which included responsibility for all medical agencies and individuals in this integrated EMS response — OCFD, EMSA, mutual-aid ambulances, and civilian volunteers. The EMS branch of the OCFD ICS is comprised of four main groups: triage, treatment, transportation, and decontamination.

I met with the commander of the citywide transport company, EMSA, and discussed our plan/objectives. We needed to establish a primary triage, direct the scores of walking wounded to the triage area, bring the critical patients to that location, and start getting supplies to the site immediately. We established our objectives based on what little information we had at that time. These were clear-cut: treat and transport the injured as quickly as possible, procure the personnel and equipment resources to handle a large demand of patients, remove the dead to a temporary on-site morgue for proper handling by the coroner's office, and establish the mechanisms for a possible long-term medical operation.

Almost immediately — before I even got to the Command Post — the radio communications were jammed. Personnel were coming to me and asking if they could assist me. I immediately delegated authority to them and assigned specific tasks, many of which involved acting as "runners" to obtain information. OCFD performs first responder/BLS citywide; 452 personnel are firefighter/EMTs.

Several ambulances from the four hospitals near the downtown area responded to the scene before dispatching even started. They were on standby or releasing patients when the blast occurred. At 9:03 a.m., the first wave of seven ambulances and two supervisor units responded to the scene from EMSA. Three or four

mutual-aid ambulances also arrived very quickly. There were already at this time many patients in several pockets around the site.

At 9:11, we set up triage at NW 6th and Robinson, near the EMS Command Post, and directed the walking wounded there. We could not communicate with area hospitals at this time, so we dispatched police units to individual hospitals to obtain available patient capacity counts. Patient treatment and packaging already were underway. We set up an ambulance staging area at NW 10th and Robinson. Two "secondary" triage areas were established quickly in the incident, one at the plaza area near the south entrance of the Murrah Building and the other at NW 4th and Harvey. They were set up, primarily by civilian medical personnel, as a natural reaction to large numbers of victims migrating to those areas. We were aware of these areas at EMS Command and were able to provide a degree of coordination, particularly by directing several ambulances to these locations.

At about 9:15, I requested all BLS medical supplies and personal protection equipment — including rubber gloves; full biohazard protective suits, including booties, jumpsuit, hat, eye shields, goggles and face shields; and disinfectants — from our fire stations.

Near command, I set up personnel staging for OCFD, mutual-aid fire departments, and civilian medical personnel. I directed that civilian medical personnel be separated from fire department and EMSA personnel and assigned OCFD personnel to keep track of these people, grouping and assigning them by medical skills and specialties. I did the same with mutual-aid companies and OCFD personnel. Maintaining control of the manpower pool was important though in the earliest stages of this incident extremely difficult: Civilians tended to remain in staging for only about 10 minutes before their desire to help compelled them to the Murrah Building.

By 9:27, approximately 10 ambulances full of patients had been transported off the scene from the triage and treatment area at NW 6th and Robinson. Ambulances also had transported numerous patients from the secondary triage locations. Treatment and transport continued at a furious pace. At 10:05, the last patients were transported out of the primary triage area.

Hundreds of medical calls and reports came in during the first hours. We had numerous calls from adjacent occupancies. Many of these injured either made it on their own to the general location of the primary triage area or were already being taken by private vehicles to various hospitals.

Ambulances transported a total of 210 patients to area hospitals from the incident site. Out of the primary triage area, 85 patients were transported by ambulance and 25 patients by other means. Many victims were transported to health-care facilities by private vehicles; some even walked.

At 10:21, we moved the triage and treatment area one block south to NW 5th and Robinson. We moved the ambulance staging area three blocks south to NW 7th and Robinson.

At 10:30 the scene was evacuated in response to a bomb threat. The evacuation was emotionally and mentally draining on rescuers, some of whom came to me with very sad faces and stories of having to leave live victims in the building.

Once we returned to the Murrah Building, we had established greater accountability of personnel under EMS Command. We were able to assign tasks by organized groups. Fewer than 20 live victims were pulled from the building after the bomb scare, and for all but three, this was accomplished in short order. By 11:15, no more live victims were found, except for one — Brandi — who would be found much later.

At approximately 1 p.m., EMS Command was moved down to the building site and set up in an area adjacent to Rescue Command in an attached parking garage on the west side of the Murrah Building. We reassessed our supply and equipment needs, ordered necessary items from logistics, and organized the equipment accordingly. At this time, we also addressed our personnel and equipment decontamination procedures and established a system for disposing of biohazardous waste collected from the site.

With live victim discoveries coming at a slow pace, we de-escalated all medical personnel not needed at the scene. By 3 p.m., rescuers had extricated a 25-year-old female and a 21-year-old female. At this point, there were no known live victims in the Murrah Building.

At 3 p.m., we established a medical plan that provided for the potentiality of finding a pocket of victims or many injured rescuers. The transport company had de-escalated its ambulances down to approximately eight on standby: Four were stationed at the site and the rest at an off-site field hospital set up by a D-MAT (this agency reported to the EMS Command Post in

the early afternoon). The on-scene ambulances were stationed at the east, south, and west sides of the Murrah Building — none were placed at the north side because of the lack of dependable egress from that area, busy with rescue operational components/equipment. Egress/ingress routes for these apparatus were specified. The Oklahoma City Police Department worked with us closely to ensure that all predetermined routes remained open.

Once the USAR teams came into place, late the first day, I remained in close contact with the medical team within each team. Each team had a doctor who worked 12-hour shifts; a doctor was always on duty. I made them aware of the medical plan, which was modified according to how the rescue effort was going. For example, the number of standby ambulances on the scene was adjusted according to the number of rescuers on the scene. If we had fewer rescuers, the number of ambulances was decreased. The minimum number of ambulances on the scene was two, the maximum four.

Health and Safety Issues

Part of my duties included on-site health and safety of rescuers — the "decon group" in our ICS. From the beginning of the incident, all rescue workers were directed to wear Latex gloves underneath their leather gloves. All personnel working in the building the first two days were disinfected head to toe and were directed to totally scrub their hands and wear HEPA (high efficiency particulate air) respirators in case the building presented some type of respiratory hazard. Two decon stations were established. They were staffed 24 hours a day with three to six personnel.

After our personnel deescalation on Day One, I put together a task force of four personnel to patrol the scene with biohazardous bags to start the process of collecting and removing biohazardous materials from the blast area. Once the bags were full, they were put in boxes and placed in the refrigerated trailer. These personnel also collected all the biohazardous materials at the two decon stations. As they made their rounds, they ensured that the stations had plenty of disinfectant solution in their systems. They also checked to see if the stations needed additional supplies or equipment. Later into the incident, rescuers who had direct contact with the bodies or who put them in the body bags wore Tyvek suits. The suits were disposed of and the workers were limitedly decontaminated. One of the innovations we made on the second day was using garden sprayers for disinfecting. They proved effective, especially for large areas; they also made it possible to decontaminate workers more quickly. A phenolic disinfectant solution diluted to a 200-to-1 ratio was used. We used a proportioner to premix the concentrate. These procedures were kept in place throughout the incident. All facilities available for OCFD — decon, transport, medical care, and so on — were available to the FEMA USAR personnel working at the Murrah Building.

On Day Five, the Centers for Disease Control; the State health department; EMSA and OCFD Medical Director, Dr. Peter Maningas; and I toured the incident site. We established that all health safety standards — except those for sanitation of food and hand-washing facilities at the restrooms — were being met or exceeded. Decontamination of personnel became optional for workers not contaminated at the scene. Rescuers who had been contaminated were decontaminated and disinfected.

EMS Command was staffed 24 hours a day. I delegated one individual to brief rescuers in teams of 25 when they came from resources so they would be prepared when called into the building. All personnel were briefed on the biohazard and respiratory risks inside the building and were issued personal protection equipment. They were fit-tested for respirators and trained in their use and methods for detecting when the respirator was not functioning properly. The briefing took approximately 10 minutes.

Personnel from my staff served as liaisons to the medical examiner, remaining with the medical examiner at all times. The responsibilities included coordinating with rescuers when a victim was ready for retrieval and expediting the process of handing off a victim to the medical examiner's office.

Lessons Learned

- One of the problems we faced before the bomb threat and evacuation was unaccountability for the many civilian medical personnel who had come to the scene in response to media requests and who were not following the ICS. Lack of perimeter control before the bomb scare made it possible for unassigned civilian medical personnel to leave staging and get through to the bomb site. Effective perimeter control was established after the evacuation, and a personnel accountability system was established. Accountability is critical in mass-casualty

incidents — not only for personnel safety but also for effectiveness in patient treatment. Escalate incidents slowly, if possible. The high blitz is very dangerous because span of control becomes very difficult to maintain. Personnel should be held in staging and used as necessary in accountable groups. Staged personnel should be grouped according to skill levels, and a member of each group should be delegated as the group supervisor.

- When mass casualties are involved, call early for the needed medical equipment in anticipation of an extended incident.
- Fire department managers should not get immersed in individual patient treatment during mass-casualty incidents. Looking back, it was hard for me to pass by the people who were bleeding, but it seemed the only thing to do, not knowing how many injured there were. Remember, however, your big-picture goals and tasks within the ICS — if you are treating patients, you're not implementing command.
- Set up lines of authority early. Tasks must be delegated. One person cannot take care of all tasks. Personnel were assigned to take full charge of areas within my command, such as triage, transportation, medical communications, and medical logistics.
- All personnel must be briefed on operational hazards and risks. These should be posted in an area where they can be read by all. Prebriefings should be held for all personnel before they enter the immediate incident area.
- A close working relationship with local law enforcement is needed to maintain egress/ingress ambulance routes. The Oklahoma City Police Department was invaluable to this end — without its efforts, we would have been in trouble. Keep streets clear for essential medical traffic.
- The incident commander must be flexible and make changes in the operational plan as the incident dictates. This was evidenced in the strategic positioning of ambulances, moving the triage area forward, and so on.
- The length of incidents of this type is a big challenge for fire department managers. Rotation of managers is an absolute necessity.
- Operational meetings should be held as often as necessary. The entire incident command staff must know which direction the incident is taking. Meetings should start at the commander level and gravitate down to the operational commands.
- Goals and objectives must be set and estimated time lines established. An action plan must be devised and followed. These goals and objectives should be posted for all personnel to see.
- The potential for biohazards at this incident was great. During the course of the response, our concerns went from bloodborne and airborne diseases to various bacterial infections. Always begin your health and safety protocols at the highest appropriate level and deescalate as it is determined safe to do so (by competent medical authority). Establish personnel decon protocols for biohazardous risks as well as protocols for properly disposing of biohazardous waste. Failure to do so at an extended mass-casualty incident could result in major medical problems.
- Assess all unknown personnel. Observe them as they perform their tasks and replace them if necessary. They must know what their specific tasks are and what is expected of them before they go on-site. There is no time to retrain personnel.
- A Logistics liaison should be established to expedite resource procurement. The liaison should meet with the operations person, who would show the liaison exactly what a project entails. The liaison would order the supplies and equipment needed. Operations officers do not have the time to order each item and put the items together to create the project. If Logistics does not understand what is needed, Logistics should send a person over to Operations for a face-to-face meeting.
- Medical Command should have personnel available when needed. There should be an action plan for pooling resources. The IC should know if and when additional resources will be needed.
- Medical supplies should be ready to go and available for a mass-casualty incident.
- Conserve equipment. Much equipment is used during an extended incident. As much equip-

ment should be recycled (decontaminated) as possible. Do not let the rescuers carry equipment from the scene.

- Monitor your decon site. During this incident, a volunteer donated a disinfectant to one of our decon sites. It was not properly marked, nor was it communicated to personnel exactly what the vessels contained. Instead of a diluted solution, disinfectant concentrate was used in the decon of three firefighters, who received first- and second-degree chemical burns. From that point on, I posted directives at all decon stations that only solution authorized by OCFD was to be used.
- Training for specific tasks takes time. Personnel working on rotational shifts will help promote a better learning curve. Those going off shift should brief personnel on the next shift on the objectives that have been met and those that are to be accomplished on their shift.
- Use a tape recorder to document the proceedings of the incident. In addition to providing documentation, this system will update your replacement on the next shift, saving the time that otherwise would be needed to exchange information. It will also be a useful learning tool after the incident.
- Provide for an off-site local donations coordinator and storage area, apart from the incident logistics area. Logistics, however, should be kept up to date on the off-site inventory. Thousands of dollars worth of donated medical supplies were wasted in this incident.
- Develop a disaster plan and practice it regularly. All agencies that will be involved in the incident — including hospitals and their emergency departments and all area emergency medical services, fire departments, and law enforcement agencies — should participate in the training.

Dispatch

OCFD Dispatch is staffed by 15 firefighters assigned to three 24-hour shifts, five people per shift. It has three radio consoles — two for dispatching and one supervisor console. Each console has four radio channels — a primary operating channel, two backup channels, and a mutual-aid channel, the communication channel for multiple agencies assigned to one incident. Console radio channels can be changed at any time with the push of a button. A message then is broadcast to all fire department rigs to do the same with their personal radios. Each console is also equipped with an E-911 telephone and a telephone equipped to receive calls over the seven-digit emergency number. This phone has a rollover for up to seven emergency calls. It also has two incoming lines for non emergency calls.

The five dispatchers assigned to work on April 19 had reported for duty by 7 a.m. The audio test for all the stations was given at that time, and the radio test for all fire department rigs was given at 7:05 a.m. Over the course of the morning, there was the usual assortment of medical calls, car fires, and automobile accidents. By 9:00 a.m., things had slowed to the point where we had only one or two medical calls working and minimal radio traffic; the office was fairly quiet. Engine companies were preparing to do building inspections in their districts. The chief and assistant chiefs were on their way to a morning meeting. Everything seemed on course for a normal day. At 9:02 a.m., however, things changed; and life as we knew it would never be the same again.

At first, the building shook and the windows rattled. Then, almost immediately, the phone lines started to light up. Most were calls from alarm companies reporting signals from businesses. Others were from the public, reporting some type of explosion and seeing smoke. By the time the first-arriving company at the Alfred P. Murrah Federal Building reported the situation there, every phone line in the dispatch office was lit up. With four people answering phones and one person monitoring radio transmissions, the first alarm was dispatched at 9:04. The normal first-alarm assignment responded: four engines, two trucks, one squad, and a district chief. Also, on the way to the scene were the chief and assistant chiefs who had been in the administrative office located six blocks west of the Murrah Building.

The arrival of the chief on the scene brought the call for a "general alarm" (the dispatching of every available piece in the department to the scene.) This put radio traffic at an all-time high. Having multiple radio channels always has been a benefit, but it proved to be invaluable during this ordeal. For the rest of the morning — and weeks to come — the companies on the scene operated on the primary channel, which we monitored and which was dedicated specifically to the incident. All other radio traffic came in to the department on the second and third backup channels.

In addition to what was going on at the Murrah Building, we now had a second problem to deal with: We still had to provide coverage for the rest of the city. In the middle of all the calls reporting the explosion, we were also receiving calls from surrounding agencies offering their support. These agencies provided people to staff the vacated stations until additional personnel could arrive; this is where the mutual-aid channel came into play. It made it possible for Dispatch to communicate with the other agencies without any problems. Companies would be dispatched from the stations and then given any additional information or directions over the radio.

Meanwhile, in the Dispatch Office, phone calls were still pouring in nonstop. Not only were calls still reporting the explosion, but medical calls and fires were being reported also. As reports of the explosion were being broadcast on television, calls were coming in from all across the state offering supplies and assistance in the search. To help handle the volume of incoming calls and to provide assistance, off-duty dispatchers were called in around 10 a.m.; another crew was called in around 4 p.m. This steady stream of calls continued throughout the night; thanks to the agencies who manned the stations and the off-duty personnel who came in to answer phones, the city maintained its proper coverage. No calls went unanswered. At the height of the incident, eight dispatchers, including the chief dispatcher, were working around the clock.

Communication between companies at the bomb site and Dispatch was a priority from the time the first company arrived on the scene. To help simplify communication during the recovery and rescue efforts and to limit radio traffic to emergencies and vital information, cellular phones were used. As personnel checked in for duty at the Command Post, individuals in charge of specified areas were issued phones. Subsequently, all requests for supplies or changes in staffing would be relayed by telephone. Each division was given a list of numbers compiled at the Command Post, keeping radio transmissions at a minimum.

Tool Use

The first 12 hours on the scene of the Oklahoma City Bombing required extreme caution as well as proficiency in the application and use of the equipment. A misplaced aerial ladder against the side of an unstable floor, the cutting of structural sensitive rebar, ignition of flammable debris — any of these scenarios could have meant disaster for survivors and rescuers.

Initial Response Equipment

The equipment used during the initial response was basic fire department equipment. Following is a rundown of the equipment that aided in the search and rescue efforts.

Cellular phones. Communications are always a major hurdle at a large incident; at this incident communications quickly became a problem. The number of fire department personnel who needed to communicate with each other at the incident made radio communications next to impossible. The solution was cellular phones. By using almost 1,000 donated cellular phones, virtually all personnel — from federal to local responders — were able to keep in constant communication with personnel at the scene as well as across the country. This opened up radio traffic for rescue operations.

Lighting. One of the first priorities was search and rescue. Initially this was achieved by covering every inch of the exposed portion of the building. It quickly was determined that additional lighting would be needed in the heavily damaged areas of the structure. Clip-on or hands-free flashlights were used for initial, quick searches until additional lighting (telescoping lights for nighttime operations, for example) could be established. Hands-free lighting was important, since personnel needed their hands for carrying tools, digging for victims, running power equipment, or simply hanging on. Lights requiring disposable batteries were used the most because of the magnitude of the task of trying to recharge hundreds of batteries.

Shears, cutters, and spreaders. Hydraulic cutters/spreaders were used early in the search for victims. Shears proved useful for cutting rebar, sprinkler pipes, and water pipes. Spreaders aided in lifting small slabs of concrete and also for slowly breaking off the edges of large slabs. The major problem with these units was mobility. There was no easy way to move them around due to unstable footing and the fact that short lengths of hydraulic lines usually required generators to be close to the operation taking place.

Saws. Once the walking wounded were rescued from the building, the use of hand tools increased. K-12 saws were used to cut rebar one inch in diameter and smaller. These saws did a fantastic job clearing away the thousands of twisted and confining pieces of exposed rebar.

They proved to be less successful in cutting through file cabinets that were twisted and entwined throughout the rubble, however, because of their small blade diameter (12 to 14 inches).

Extinguishers/pump cans. With the use of K-12s also came the need for extinguishers or pump cans. Every inch of the building was covered with papers and books waiting to be ignited. Because of the volume of paper products, a lot of times the equipment — saws and cutting torches, for example — started small fires. Handlines were in place surrounding the building, but because of lack of access to all parts of the building, five-gallon pump cans were vital in extinguishing the spot fires.

Cutters. The small hand tools used most were tin snips to cut through file cabinets, metal desks, air ducts, and office dividers and wire cutters/dikes to cut through miles of phone and computer cables. Hundreds of these tools were handed out.

Buckets. These were essential for removing thousands of tons of pulverized debris. The enormous force of the blast literally pulverized the structure's midsection into hand-size pieces and smaller. Buckets proved invaluable in removing the debris and mountains of destroyed books and papers.

Wheelbarrows. These proved very useful in shuttling equipment and supplies.

Sledgehammers. These were used to open small areas inaccessible to firefighters, a process that was slow and exhausting but valuable in the early stages of rescue. The constant threat of further collapse was prevalent, so the limited shock of the sledgehammer was preferable to that of the jackhammer.

Prybars. Various lengths and configurations provided the needed leverage in confined areas to separate debris from file cabinets or desks and to achieve greater access or to simply create an avenue for a visual inspection of the area. An attempt to use lift bags for the purpose of separating slabs of concrete proved unsuccessful due to the slabs' enormous weight.

Army shovels. The hand tool that was the backbone of this entire operation was the standard folding Army shovel. This piece of equipment provided the ability to penetrate the loose debris that had filtered into the voids between massive slabs of concrete. These small shovels allowed rescuers to precisely remove the desired amount of debris in the search for victims. I can't emphasize enough the importance of hand shovels and buckets. Everywhere you looked on the face of the building you would see crews of workers with hand shovels and buckets removing debris. This may seem antiquated, but it was the only way to remove this type of small rubble.

Ropes. These were needed for several different operations during the early stages of rescue. Safety lines and rappelling harnesses were used to access damaged areas that could not be reached by other means. Utility lines were helpful in lowering hazardous debris such as large sections of glass and granite and office furniture and equipment. Ropes also were used to secure large objects for short periods of time to allow rescuers to operate underneath them. When dealing with a nine-story building, you would be surprised at the amount of rope needed for all of these operations.

Within approximately six to eight hours of the start of operations, all surface rescues had been completed, and the heavy work began.

Shoring and Cribbing Equipment

Structural engineers determined large portions of the building were unstable and that shoring and cribbing procedures should be initiated as soon as possible. To achieve this goal, the following equipment was used:

- For short-term debris stabilization, low- and high-pressure air lifting bags were used to shore slabs of concrete and allow rescuers to retrieve victims. Winches and come-alongs provided quick stabilization of large debris such as slabs of concrete left hanging throughout the building and huge file cabinets teetering on the edge of the remaining floors. Both of these items allowed for quick retrieval of bodies from unstable areas without requiring extensive shoring and cribbing.
- For long-term stabilization of the building, chain saws were used to cut though heavy timbers, and 10¼-inch circular saws and 7¼-inch worm drive saws cut wedges and 4 x 4s into desired lengths. Nail guns were used due to the large amount of cribbing that had to be done and the restrictive work areas. Power-actuated fastening guns allowed quick securing of cribbing and shoring to concrete slabs and attaching barrier fencing around each floor or what remained of

the floor to keep debris from falling on rescuers below.

Cutting Concrete to Reach Victims

Using specialty tools to penetrate the massive slabs of concrete and reach trapped victims was the next priority for rescuers. Numerous generators and compressors were on-site by this time, allowing for the use of power and pneumatic equipment.

Jackhammers were utilized virtually 24 hours a day to reduce the size of massive slabs of concrete that were once the floors of the building. Personnel operating the jackhammers worked closely with structural engineers and crane operators. The demolition crews operating the cranes provided valuable information on where and how to demolish the slabs so they could attach slings to them for removal by cranes, which reduced the workload as well as man-hours for removing this type of debris.

Oxygen and acetylene torches were of tremendous assistance in the never-ending battle with rebar. At least four torches were in operation at any one time. The amount of rebar in this building is hard to describe, but you could not take a step without touching some. These units also were utilized around the clock. Two of the torches were equipped with 8- and 10-foot extension wands that enabled cutters to reach areas too unstable to stand on or to stay clear of hanging debris as it was cut loose.

While the interior and subsurface portions of the building were being stabilized, a massive assault was mounted on the face and "the Pit" areas of the building. This effort was enhanced by the help of FEMA's USAR teams. The specialized equipment and knowledge they provided proved to be extremely beneficial.

One extraordinary piece of equipment was a large gas-powered hydraulic pump with several hundred feet of lines used to power tools. This unit could power a heavy-duty breaker or jackhammer and heavy-duty circular saws capable of cutting through 10 inches of concrete in a relatively short time. Rappelling teams used medium-size electric drills to drill holes through concrete slabs left hanging from the explosion and secured them to the stable sections of the building. Hydraulic drills or rotohammers were used to drill holes through concrete so search cameras could access the voids. Each team could be assigned to different locations on or in the building without depending on outside resources for equipment. The hydraulic power unit and the entire cache were self-sufficient. This is important in a disaster spread out over a large geographic area.

Lessons Learned

- Firefighting gear is just that! Bunker gear, as we refer to it, was too bulky and hot; the standard structural firefighting boot was too heavy and did not provide enough support for the rough terrain; and the helmet was difficult to fit into tight spots and was quite heavy after a 12-hour shift. Through the generosity of Tinker Air Force Base and the citizens of Oklahoma City, lace-up leather boots, military fatigues, and hardhats were provided, along with leather gloves, eye protection, back braces, and knee pads, which proved to be invaluable. This lighter gear reduced the heat stress along with the physical demands caused by the firefighting gear.

- There must be a way to control the whereabouts and the condition of equipment. At this incident, there was no shortage of equipment, but keeping track of it was an issue. This problem was solved through the use of the ICS system. The equipment first was delivered to Logistics, where it remained until it was requested on the scene. It then was taken to a holding area, where the person requesting it signed for it. This allowed for tracking of the larger equipment on-site. As for the hand tools, a large supply was kept on-site at an equipment storage area and handed out freely to any rescue worker on-site. When shifts changed, the small equipment was gathered and redistributed to the next crew.

- Two equipment holding areas for larger equipment were established at the site. Despite the limited access to the building, workers could obtain equipment without having to hike a great distance. Each day a person or persons were assigned to assist teams in locating equipment and servicing it in the field. This proved extremely beneficial for the rescue team. The tool man would refuel power tools and generators, change saw blades, replenish low cutting torch bottles, refill pump cans, replace broken hand tools, and locate any special equipment for rescue teams. This eliminated teams' having to shut down or slow down due to equipment problems. If any equipment not on-site was