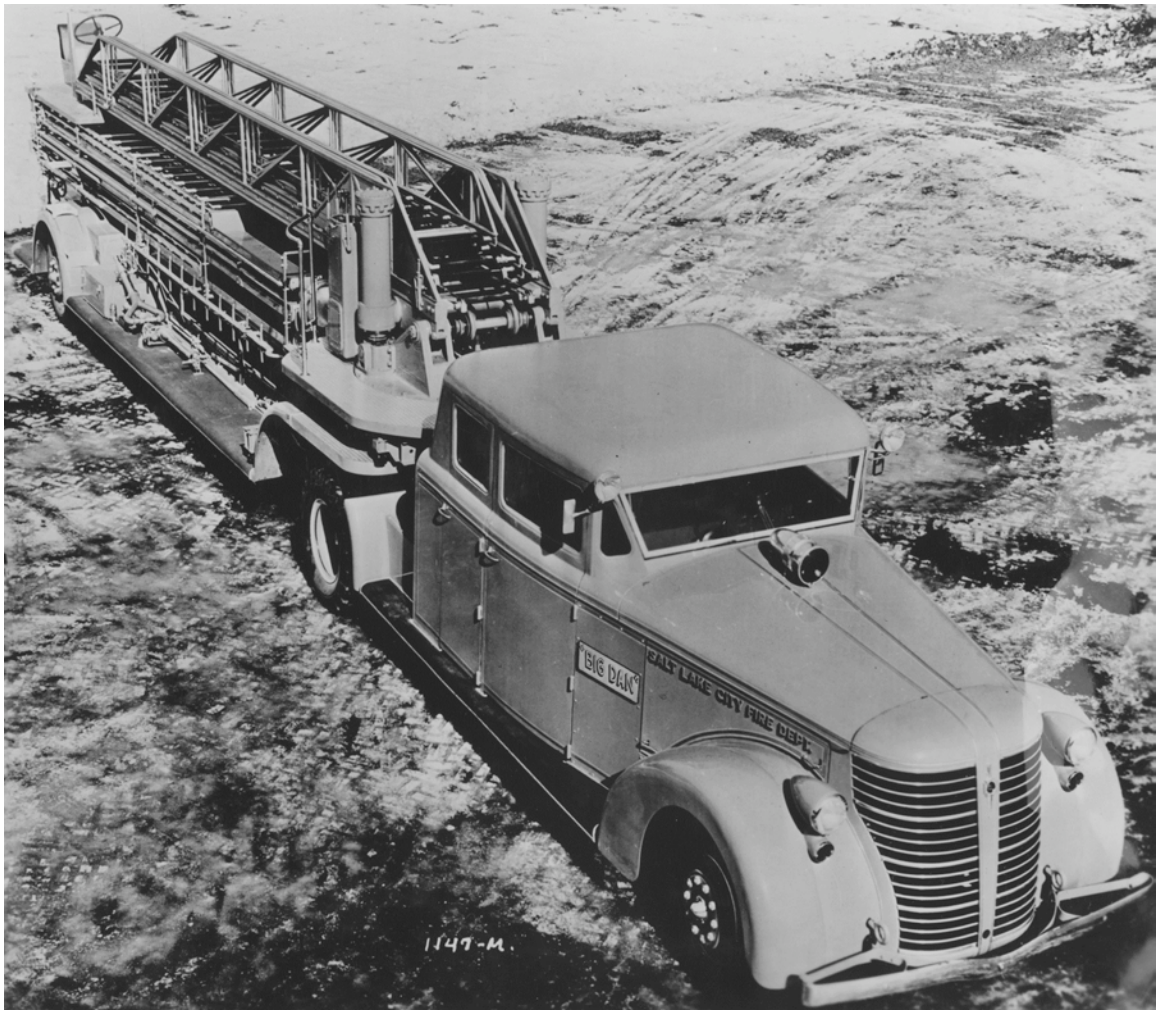
Paul Hamilton June 19, 1943

By: Steve Lutz

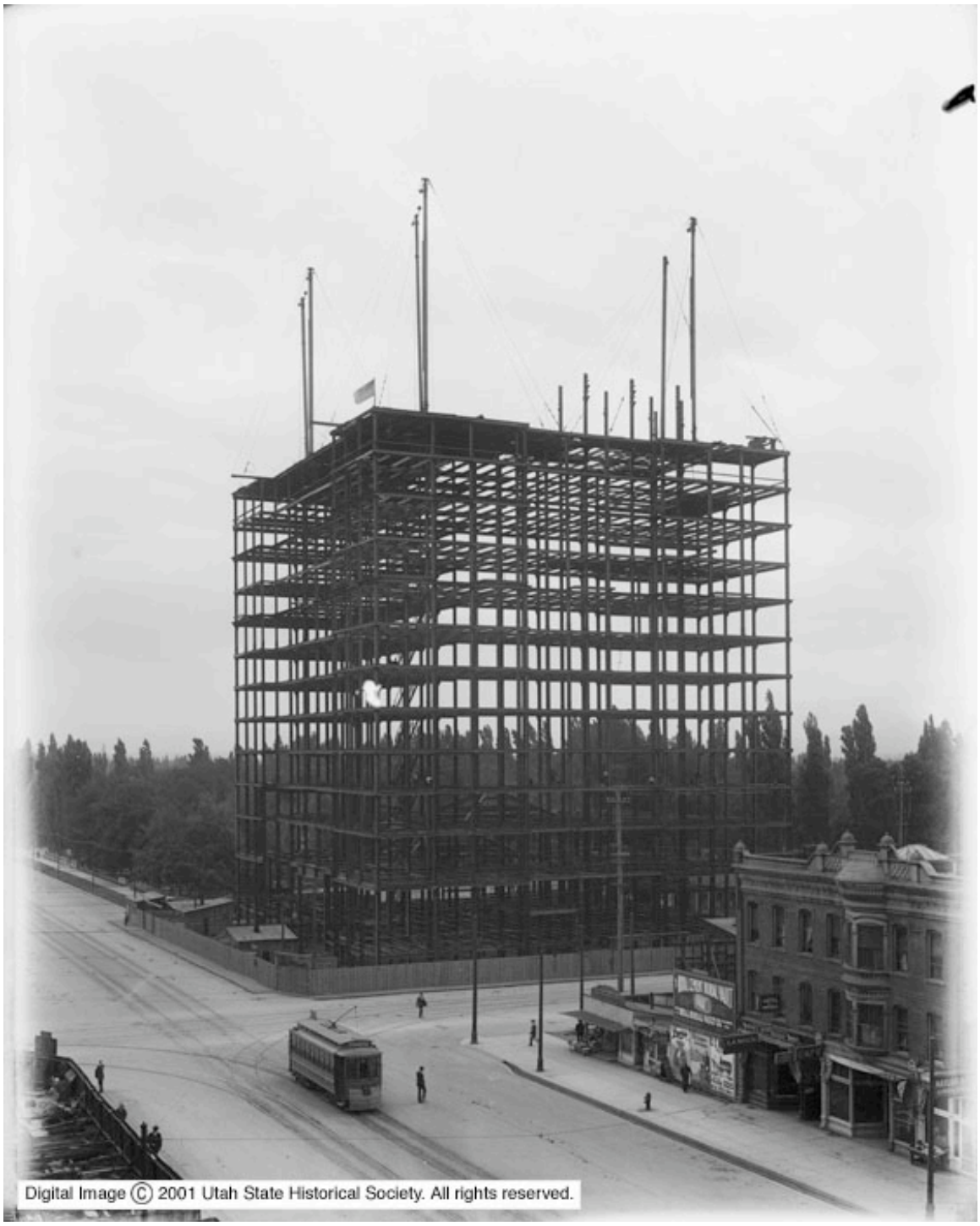
The 1941 American Lafrance ladder truck affectionately known as Big Dan was the pride of the Salt Lake City Fire Department. It was the $29,000 centerpiece of parades and emergency scenes, its 100 ft. steel ladder was state of the art. Of course ladders like that are not used on most fires but when needed to reach high above the street for rescue or elevated stream usage, nothing else comes close. Just such a situation seemed to present itself in June of 1943. A call came into the Salt Lake City Alarm office on the night of June 19th. There was fire on the 9th floor of the Hotel Newhouse on the corner of Main St. and 400 South.



Factory Photo of the 1941 American Lafrance 100 ft. Ladder truck "Big Dan" .

Samuel Newhouse, the son of Jewish immigrants who had made a huge fortune from mining in Colorado and Utah wanted the south part of downtown Salt Lake City to be the financial center of the West and a counterpoint to the power center four blocks north at Temple Square. Accordingly, he and his investors built the Newhouse and Boston

buildings, Salt Lake's first skyscrapers. They still stand proudly on Main St. at Exchange Place. Then to provide high class lodging in his new financial district he built the grand Hotel Newhouse. Construction began in 1909 with the intent of making it as safe and modern a structure as possible. It was a thoroughly state-of-the-art highrise of noncombustible construction, steel framed with concrete floors, and walls. The elegant brick and stone exterior soared over downtown. The interior appointments were equally elegant with beautiful ballrooms and restaurant. It was the scene of many conventions, social events and meetings of the movers and shakers of Utah and the west. It had its own parking garage and service station. Wet standpipes for fire protection extended to every floor with 1 ½ inch hose and nozzles in cabinets on every floor. The construction may have been non- flammable but the contents would and did burn.



The Hotel Newhouse under construction, 1909

Three soldiers from Dugway were guests in room 922 on the north side of the hotel. One of them, Sgt. John Gfoer fell asleep alone in the room when the fire started from his cigarette. He escaped with only burns to his feet. Miss Virginia Owens, the elevator operator smelled smoke and called for help. While the desk called the fire department

two bellmen rushed up and tried to extinguish the fire with pans of water and an extinguisher, but the fire had already gotten too big for them to control.

The room directly above the fire was occupied by Mrs. John Handal and her infant daughter Wanita. She left the baby in the room with friends Sgt and Mrs. John Cox while she and her husband, a soldier stationed at Camp Kearns, enjoyed the rare treat of going out to dinner. When they heard the sirens, they raced back to the hotel and were terrified to see smoke billowing from the window of the room directly below hers. They frantically tried to get up to the 10th floor by elevator but were restrained from doing so. They tried the stairs and were stopped there too.

The first alarm assignment for any downtown box typically included Engines 1,2 and 4 Ladder 1(Big Dan) and a Battalion Chief. It took only a few minutes for the rigs to get to the Newhouse from Station 1 about 3 blocks away and Station 2 about 7 blocks north. The response was quickly upgraded to a general alarm, which brought many more units to the scene.

Big Dan pulled up near the northwest corner of the building while engine crews went in the front door of the Hotel and headed upstairs. Lt. Kresser began to raise the ladder while the crew laid 2 1/2" hose to extend up the ladder if an exterior attack was needed. According to the crew, the ladder was fully extended and well away from the wall of the building just below the fire when Fireman Paul Hamilton went up first to secure the uncharged hose and to man the nozzle. Quickly firemen John Boshard, John Andrew and Ralph Ponderzay joined Hamilton on the ladder to secure the hose to the ladder with straps. The engine operator charged the line to the ladderpipe, which whipped around on the ladder as Lt Kresser started up. The ladder began to sway while the firemen on topped yelled at Kresser to "Tow her down".

North side of Hotel Newhouse ca. 1915

Any truckie will tell you that being on top of a swaying hundred-foot ladder is a very uncomfortable situation. The tip on a ladder of that vintage can move as much as 6 ft. just from firefighters moving around.

To understand visually what happened next, take a tape measure and pull out about 4 ft. Hold the extended tape at about a 65 degree angle. Now flex your wrist ever so slightly so that the tip moves up and down to simulate the hose/nozzle reaction and the movement of firefighters. Notice how movement at the tip is greatly exaggerated. The top edges and bottom curve of the tape will alternately be under compression and then extension. Twist your wrist ever so slightly. Suddenly, the tape will collapse near the bottom. That is almost exactly what happened to Big Dan's steel ladder.

The ladder began to twist and then buckle. Hamilton, Boshard and Ponderzay tried to get down but instead rode the broken ladder to the sidewalk. Andrew was apparently caught in the ladder. Some eyewitnesses reported that one fireman was pitched from the ladder into the street where the roof of a parked car somewhat broke his fall. The entire ladder collapsed onto the sidewalk on the west side of the building. 34 year old Hamilton died quickly of massive trauma.

The ladder came to rest in a giant inverted V with a bend at the base and another at the fourth floor with the tip resting on the ground behind the hotel. Hamilton and the injured men were taken to the Emergency Hospital

Meanwhile, Mrs. Handal was in a panic and on the verge of collapse trying to find a way up to their room when she shrieked, "There's my baby…thank the Lord." Sgt. and Mrs. Cox had left the room with the Handal's baby carefully wrapped in a blanket. They could not get to the fire escape or use the elevator. Mrs. Cox fell in the smoke filled hallway and injured her knee. They found their way to a rear stairway and made it down ten floors to safety. Sgt Cox told a reporter, "It was plenty hot and there was plenty of smoke." Wanita Mary was fine, "She just smiled and goo-gooed at the crowd."

This tragedy came less than a month after 3 firefighters died a block away at the Victory Theatre when a balcony collapsed on them. Mayor Ab Jenkins left a meeting concerning an inquest into that fire and rushed to the Newhouse. Authorities had the area of Big Dan's collapse cordoned off and Jenkins fired off a telegram to American Lafrance demanding that company engineers fly out immediately to determine the cause of the failure. Guards remained with the truck until the Lafrance engineers arrived the next Monday and conducted their examination.

Fireman John R Boshard suffered multiple jaw fractures, numerous lacerations and contusions. No one informed his family until the following morning. His daughter said, "We didn't even know there was a fire until one of the firemen called mother around 8 am and said dad was in the hospital."

The wife of Ralph Ponderzay stated, "Ralph didn't get a bit of sleep last night. He was terribly tired, but the excitement and the pain from his right ankle and cuts on his left leg bothered him a lot. He told me that he was almost choked to death by the hose strap, but he finally wriggled out of it before the ladder broke. He fell 50 feet and they think his right ankle is fractured."

Mrs. Andrew said that the doctor ordered her husband to stay in bed for several days. "He suffered greatly from emotional shock, in addition to the chest injuries and bruises."

All three injured men were taken to the hospital but Ponerzay and Andrew were allowed to go home after treatment but Ponderzay was back in the hospital the next day for more definitive care than he could get at home.

A few days later 700 people gathered for Lt. Paul Hamilton's funeral. 60 uniformed firefighters lined the route of women carrying flowers to an engine that carried the casket to Wasatch Lawn Memorial Park.

The total damage to the hotel and its contents was less than $2,000. The rooms were ready to reoccupy in just a few days.

The next week Lafrance engineers Lee Estes and Hubert Walker arrived to examine the wreckage. They told City Attorney E.R Christensen and City Engineer W.D. Beers, the men charged with investigating the accident, that there was no defect in the design, construction or materials of the ladder and that the collapse was the result of the operator striking the side of building by moving the turntable with the charged line and the four fireman on the ladder. Assistant Chief Lloyd Egan, Lt. Kresser, the operator and Battalion Chief Don White, an eyewitness, vehemently denied that version of events. They also insisted that training and ladder testing was 'By the book", specifically Lafrance's own manual on the truck.

The Mayor requested that metallurgists and engineers from the U.S. Bureau of Mines examine the wreckage and do a scientific analysis of the failed areas. Using microscopic photography, the scientists, T.R. Graham and James Long documented numerous cracks and poor welds. Porous welds with little penetration and thermal cracks formed at the time of welding substantially weakened the structure. They determined that bad welds in the handrail of the bed section of the ladder failed under tension. They went on to say, " The welding material is gassy and porous…There is a lack of fusion at the overlapping joint…This is the worst condition that can be encountered…cracks and fresh fractures suggest that welding operations produced the course, brittle structure."

At the conclusion of the presentation on the investigation to the City Commission, Mayor Jenkins asked the City Attorney, "…you found the firemen to be absolutely in the clear?"

Attorney Christensen replied, "There was nothing in the firemen's conduct to cause the ladder's collapse."

Mayor Jenkins then said to Christensen, " Make demand upon American Lafrance for a new fire ladder in lieu of the defective ladder and for such other relief as the City is entitled to, by reason of losses suffered…"

Lafrance continued to deny they were at fault but curiously enough, moved quickly to replace the ladder at no charge to the City and wrote a check compensating the Hamilton family and the injured firefighters. This may have had something to do with the failure of a similar Lafrance apparatus in Boston at almost the same time. It is likely that Lafrance just didn't want any more bad publicity and wished to avoid a lawsuit.

This was a relatively new design of ladder in 1943. Steel ladders operated by hydraulic systems were beginning to replace wooden spring-raised ladders. The main beam of the ladder was an "I" structure made of thin layers of steel. Rungs went through this "I" and were welded on each side of both beams. The square tubular hand rail was a crucial part of the structure made of a top rail, upright and angle bracing all welded together to the beams. This made for a more rigid structure. It had a major difference from today's ladder designs in that there were no diagonal braces from the rungs to the rails. Such "K" braces provide a great deal more lateral stability.

The same basic design was used for most the next 50 years until the 1991 edition of NFPA 1904 specified a minimum tip load of 250 lbs with a 2:1 safety margin on all components along with a number of other improvements. Many ladders already exceeded that specification before 1991 but some did not and quite a few also failed, causing numerous deaths and injuries of firefighters as well as fire victims.

To understand the reasons for these failures one has to understand the three types of force that a ladder may be subjected to: tension, compression, and torsion. When an aerial ladder is raised to an angle of less than 90 degrees, the top rail of each section is under tension. The weight of the whole assembly is stretching that member while the beam is being compressed. If the tip of the ladder is rested on an object such as the top of a building, then the forces are reversed. The top rail is compressed, the bottom tensioned.

Lateral forces such as wind or rotation of the turntable can exert significant compression and extension forces on the side structures of ladders. Ladders without crossbracing between rungs and beams are especially susceptible to damage from this type of stress. A collision with a fixed object while the ladder was moving sideways is the alleged cause that the Lafrance engineers laid on Big Dan's collapse and that the department denied.

Torsional (twisting) forces are very hard on ladders. For example when one side of a ladder tip is rested on something while the other side is cantilevered, tremendous assymetrical forces may exerted on the ladder. Big Dan may have been subjected to torsional force when the fire hose running up the ladder was charged. Loads are also either static (simply the weight) or dynamic (weight and movement). The sudden addition of a dynamic load is often called shock loading.

In general the maximum safe extension distance of a ladder is reduced significantly by the use of a ladder pipe or a hand held nozzle. Ladders are equipped with an inclinometer which measures the angle. Some inclinometers actually show safe angles and extension distance with and without ladderpipe operation. The operating manual will delineate the safe limits for the ladder at various angles as well as extension with and without the ladder pipe operating. Operators and crews of aerials must constantly be aware of those limits and the specific forces that they may be placing on the aerial. Operating a ladder in a position where the truck is not level will also reduce the safe load. Some modern apparatus have warning systems that are activated if safe loading is exceeded.

An example of torsional stress combined with shock loading was a 1994 aerial collapse in New York that killed a man and injured two firefighters, a woman and two children. Operating at a low angle and almost fully extended, the operator rested one side of the ladder on a window sill of a 6th floor apartment in order to rescue a family trapped there by a fire. When the family evacuated onto the ladder it slipped off of the sill and the entire ladder crashed to the ground. The failure in this case was a result of shock loading that exceeded the designed limits of the ladder. Low angles and full extension are a dangerous combination. Most old design ladders were not capable of carrying even 250 lbs. in this type of situation. With the sudden stress exerted when the ladder dropped from the sill, the ladder and victims did not have a chance with the amount of load involved.

Failure can result from poor design, use of inferior materials or poor fabrication methods, overload beyond the design and/or from a condition called metal fatigue. The bottom line is this, the farther extended a ladder is, the more leverage is exerted on its bed section. It's just like adding a cheater bar to your socket wrench, whatever force you apply is multiplied. In the New York Ladder 108 collapse, engineers estimated that the combined force of the people on the ladder and the fact that the man jumped to the ladder after it slipped from the sill applied 54,000 lbs. of force to the ladder structure!

Fatigue is a failure mode that occurs in structural materials that is caused by repeat loading. Many mechanical systems must be subjected to repeat loading and others beside fire ladders have killed firefighters. Several years ago when the wings broke off of several aerial tanker aircraft on wildfire duty, the cause was determined to be metal fatigue. As the wing attachment structures were subjected to millions of bending cycles over the long lives of these aircraft, the metal weakened and then failed under the more extreme forces applied to the heavily laden structure encountered during fire attack.

Any metal will eventually be weakened by repeated flexion. Even spring steel may eventually become brittle, develop microscopic cracks and then fail. In the event of a failure, an expert microscopic examination of the damage can often conclusively discriminate between fatigue and defects in materials or workmanship. Proper ladder inspection and testing should be able to detect potential failure before a catastrophic failure occurs. Many pre-1991 ladders are still in use and since their design may not meet the later requirements, should have clearly written and communicated SOPs which take their limitations into account. The manuals for these apparatus may not clearly delineate proper testing and further research should be done to ensure that inspection and testing are done correctly.

Big Dan was new enough that fatigue was not a factor, as the engineers determined. A combination of forces and bad welding were the preventable factors that killed Paul Hamilton and left his wife Florence a widow with two young children, Paul and Joan.

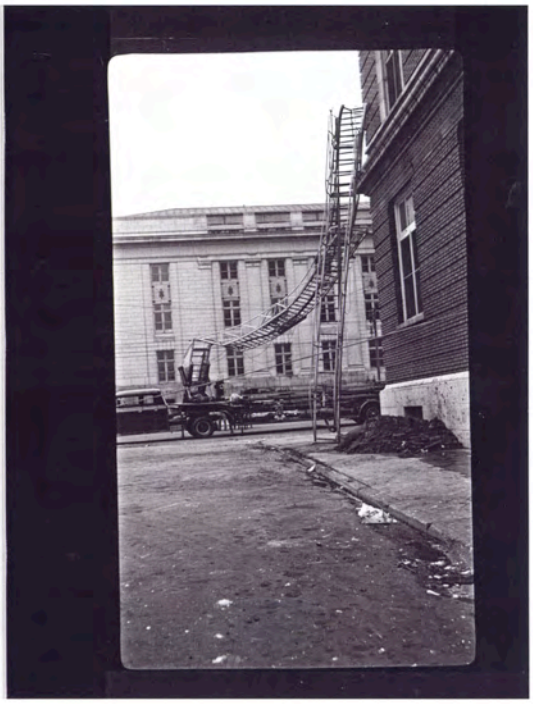
Amazingly, despite numerous ladder collapses, it took another 48 years for NFPA to impose standards on industry to correct design problems that were identified at the time of Big Dan's disaster. Even with the newer ladders it is not that hard to exceed the design and materials limits of a ladder in emergency situations or for that matter in training activities. Several ladders have failed during training. Most failures occur at low angles when the stresses are the greatest.

The 1991 and newer NFPA 1904 standard requires a minimum 250 lb. load to be supported with a 2:1 safety factor in all structural members while the ladder is operated. This means that the newer ladders must have a much greater capacity to resist bending forces than those of the older ladders.

Big Dan was repaired by Lafrance and remained in service for many years. The tractor was replaced in the 1960's and eventually the old truck was sold to the Castledale Fire

Department in central Utah where it was used until it tipped over while extended and was damaged beyond repair.

The US Fire Administration has compiled an excellent technical report entitled “Aerial Ladder Collapse Incidents” (Report 081 of the Major Fires Investigation Project) which details five events and includes a number of key issues, including driver/operator training, operating manuals, design criteria, load limits and inspection and testing.

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Four photographs taken by investigators the morning after the disaster showing the damage from various angles including an aerial view from the top of the hotel.

Case Study Questions:
What would have been the likely effect on the interior conditions in the hotel if the ladder company could have actually used their elevated stream through the window of the involved room?

What forces are placed on a cantilevered ladder (freestanding) as opposed to one with the tip supported? Which places the most stress on the ladder?

What are the current NFPA Standards that apply to design and testing of fire department aerial devices?

What departmental SOPs are in place in your area, regarding the use of aerial ladders in fire and/or rescue situations?
Are these SOPs customized for each type of aerial device currently in use and matched to the manufacturers recommendations?

What departmental SOPs are in place in your area concerning high rise operations?

What are the hazards related to performing rescue operations from an aerial ladder?