Collapse Rescue Operations At The Pentagon 9-11 Attack

A Case Study on Urban Search and Rescue Disaster Response

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Background

On September 11, 2001, as the World Trade Center disaster unfolded in front of the world, a hijacked 757 airliner piloted by terrorists flew into the broadside of the Pentagon near Washington D.C., striking the military headquarters at approximately 400 m.p.h., causing a fiery five-story collapse and killing 189 innocent people. The Pentagon disaster was part of a coordinated terrorist attack that killed thousands of innocent people from over 80 nations in New York, Washington, and Pennsylvania. The attacks caused the greatest single loss of firefighters, EMS personnel and police officers in history, and the largest loss of civilian life in a terrorist act in modern times.

Part of the Pentagon structure collapsed about 20 minutes after the impact, a consequence of structural damage from the plane's impact combined with the heat generated by thousands of gallons of burning jet fuel. The extreme heat and impact damage caused columns and other supports to fail, bringing down the building even as firefighters attacked the flames and tried to rescue victims trapped by the blaze.

Incident Command Established

Arlington County Fire Department (ACFD) Chief Edward Plaugher, in whose jurisdiction the Pentagon is located, took command of the incident and became the *Pentagon I.C.* (Incident Commander). Using standard Incident Command System (ICS) protocols, Chief Plaugher assigned an *Operations* officer to develop and implement the strategy while he managed the overall incident in a *Unified Command* mode with the military and local law enforcement and FBI. Since this was obviously an apparent terrorist attack, the entire incident was a crime scene *and* an active fire and rescue operation…a situation that calls for Unified Command).

Operations divided the incident into geographic *Divisions* (e.g. *Division A, B, C, D)* for the fire attack, EMS, and rescue operations; and into functional *Groups* (e.g. *Fire Attack Group, Medical Group, Search Group,* etc). Then came the collapse, which drastically changed the situation.

The size of the collapse area and the presence of confirmed live victims before the collapse compelled the Pentagon I.C. to divide the incident into *Branches* in order to manage the growing scale of the disaster and the large number of fire, EMS, and *urban search and rescue (US&R)* resources that would be required to handle the incident. He established a *Fire Attack Branch* (to manage all the suppression operations) and a *US&R Branch,* both of which would function until the last victims were removed and the building secured twelve days later.

The Collapse Zone

The area affected by fire from the crash measured approximately 400 x 300 feet, with all five floors and the roof structure engulfed. The collapse zone itself was approximately 80 x 240 feet, involving floors 1 through 5.

Based on standard Incident Command protocols, Chief Plaugher established , the Incident Commander (I.C.) of fire/rescue operations at this disaster, assigned command of the US&R Branch to an assistant chief and specially trained officers of the Fairfax County Fire and Rescue Department, who were on the scene at part of the response to the multi-alarm fire before the collapse (and whose department sponsors one of the United States' 28 Federal *Emergency Management Agency US&R Task Forces*).1 He also activated his

1 The Fairfax County Fire/Rescue Department's US&R Task Force is identified as Virginia Task Force 1, or *VATF-1*.

department's technical rescue team and requested USAR teams from the neighboring Alexandria Fire Department (AFD) and the Military District of Washington (MDW)2, assigning them to the US&R Branch.

US&R Branch Concerns and Operations

The US&R Branch Director began developing a strategic plan for the collapse search and rescue operations. He assigned US&R-trained firefighters on the scene to recon the collapse, evaluate the need for stabilization, evaluate the potential for live victims. Meanwhile, he recommended to the I.C. a request for four FEMA US&R Task Forces to help manage the collapse problem, which he knew would be a multi-day search and rescue operation.

Based on that request, FEMA immediately activated the following US&R Task Forces: Virginia Task Force 1 (VATF-1) from Fairfax County; Virginia Task Forces 2 from Virginia Beach; Maryland Task Force 1, and Tennessee Task Force 1. FEMA also assigned one IST-A (US&R *Incident Support Team-Advanced3),* to the Pentagon. VATF-1 left for the Pentagon at 1:30 p.m., arriving around 2:00 p.m. Members of the "Red" IST-A began arriving by 3:00 p.m. MDTF-1 arrived shortly thereafter, and VATF-2 arrived around 10:00 p.m. The Tennessee task force drove all night, arriving at the Pentagon on the morning of September 12. Tennessee would ordinarily have been transported via military cargo planes to a distant disaster like this, but because of the delays caused by the shutdown of American airspace, they chose to bypass the airlift and drove in convoy directly to the scene with police escorts on the entire route.

The national scope of the response to the collapse disasters in New York and Washington D.C. was immediately apparent. Within one hour of the attacks, FEMA headquarters personnel activated 16 US&R Task Forces (more than 1,000 rescuers, plus 64 search dogs) for the New York and Pentagon disasters.

FEMA also assigned the "White" IST to coordinate the efforts of the US&R task forces being dispatched to support the City of New York's ongoing search and rescue operations. The remaining 12 US&R Task Forces were placed on "Alert" status for activation. It was already the most extensive deployment of Federal urban search and rescue resources in the history of the United States. All but two of the nation's 28 US&R task forces would eventually be deployed either to New York or to the Pentagon, some in "round robin" rotation to ensure coverage of the rest of the U.S. while the 9-11 disasters were dealt with.

IST-A Assigned to Manage US&R Branch

In the hours following the attacks, IST-A members converged on the Pentagon, traveling by any means possible, including fire department vehicles, rented cars, and military aircraft. Some members arrived the following day after driving all night. Others (including this author) arrived after flying on a military aircraft cargo planes and Air Force helicopters.

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2 The MDW's technical rescue team consists of engineer/soldiers trained in collapse rescue operations.

3 FEMA fields three national US&R *Incident Support Teams-Advanced (IST-A),* identified by the designators Red, White, or Blue. The IST-A's are specially trained teams, **each comprised of highly experienced members selected from among the nation's 28 US&R Task Forces.** The three IST-A's are the advance elements of the complete IST's, each of which is staffed with 39 people when fully deployed at large or complex disasters. At least one IST-A is dispatched whenever one or more FEMA US&R Task Forces are activated, in order to assist the local Incident Commander with command and control/coordination of Federal US&R resources.

As the FEMA "Red" *IST-A* assembled in sufficient force to operate, command of the US&R Branch was transferred to this group on the recommendation of the Fairfax County Fire officers, some of whom are also members of the IST-A. This is an appropriate role for the IST-A, which is designed to perform the following functions:

--Command and control of US&R operations.

--Acting as liaison between the Incident Commander and the FEMA US&R Task Forces.

--Determining the mission and scope of US&R operations; developing a written memorandum of understanding with the local I.C.

--Performing a wide variety of other supervision, coordination, operational, and logistical functions to ensure effective, round-the-clock US&R operations that support the local responders and meet the overall incident objectives

--All under the command of the local I.C.

Essentially, the IST-A is an incident management team for US&R operations, provided by the Federal government and available to local Incident Commanders who find themselves managing incidents that have become Federally-declared disasters. This is a very helpful tool for Incident Commanders who may never have been faced with massive collapse rescue operations. The presence of a FEMA US&R IST-A provides the I.C. with a group of highly experienced US&R specialists who can arrive on scene rapidly (far ahead of the US&R Task Forces at times); who are accustomed to conducting large-scale technical rescue operations; and who are prepared to supervise geographic and functional areas of an incident. The I.C. can use the IST-A as he chooses, with the understanding that the IST-A will also be helping to coordinate the operations of the FEMA US&R Task Forces to ensure they are used to best advantage.

Since each member of the IST-A is also a member of his "home agency-sponsored" FEMA US&R Task Force, they are practicing US&R specialists and commanders who often have worked with other US&R Task Forces from around the nation, and often know their leaders and members by name or by face. This is an important aspect of the system: Those who responsible for establishing the US&R strategies (e.g. the FEMA US&R IST-A) are usually known to those who are tasked with developing the tactical objective and carrying them out (the FEMA US&R Task Forces), and vise-versa.

IST-A Integrated into the Unified Command

Chief Plaugher chose to integrate Red IST Leader John Huff (Assistant Chief of the Lincoln, NE Fire Department) and Assistant Leader Carlos Castillo (Assistant Chief of the Miami-Dade Fire and Rescue Department) into the Unified Command of the Pentagon Incident, joining ACFD Assistant Chief James Schwartz, Arlington Police Chief Dan Murray, Commanding General James Jackson of the Military District of Washington, and Federal Bureau of Investigations Special Agent Christopher Combs. .

This is consistent with FEMA guidelines, which emphasize the IST-A's role as a resource to assist local Incident Commanders with coordination of Federal US&R resources in support of the needs of local and state agencies. The FEMA US&R guidelines are sufficiently flexible to allow the local Incident Commander to integrate the IST into the Unified Command structure to manage urban search and rescue operations conducted by one or more US&R Task Forces.

The Unified Command team met every four hours to decide and coordinate strategic objectives. Chief Schwartz identified his strategic objective for the US&R task forces, which included ensuring reasonably safe collapse SAR operations; preventing needless injuries and death among victims and responders; locating and rescuing (or recovering) all victims from

the Pentagon; providing structural stabilization to damaged sections of the Pentagon; and supporting the recovery of evidence by the F.B.I., the N.T.S.B., the A.T.F., and the Military by stabilizing the structure and helping to locate, extricate, and remove bodies and material in a respectful manner. Throughout the Pentagon Incident, the ACFD provided a liaison to the IST leader and Deputy Leader to allow directed two-way communication.

During the unified command meetings, the IST Leader provided input from the IST and Task Force Operations Leaders that identified operational goals during each 12-hour operational period. Once agreement was achieved by Unified Command, the IST conveyed these goals in the *IST Operations Plan* for each operational period.

The IST then distributed the *Operations Plan* to all US&R resources, conducted briefings with US&R Task Force Leaders, the F.B.I., and other affected parties before each operational period, and provided continuous coordination and supervision of US&R operations and support. .In turn, each US&R Task Force would develop a written Tactical Plan specific to that task force's operations during every operational period. This is a standard FEMA US&R system approach to ensure that the task forces are operating in a manner that's consistent with the needs of the local Incident Commander, and to ensure that all resources at the disaster are "on the same page". This is particularly important at large-scale and/or complex disasters, where different resources can potentially find themselves employing opposing tactics if the Action Plan isn't transparent (or if it's not effectively communicated).

In order to assure that these US&R strategic objectives were completely understood, the IST leaders followed FEMA protocol by drafting a written Memorandum of Understanding for US&R operations with the ACFD. The agreement specified the purpose of the presence of the US&R task forces, established performance bench marks, and spelled out demobilization protocols. This development of an MOA during disaster operations is standard protocol for the FEMA US&R Response System, another example of the extent to which the system is designed to support the needs of the local entities and ensure their requirements are formally addressed.

Strategy

Based on their collective experiences at collapse disasters in far-flung places like Northridge, San Francisco, the Philippines, Oklahoma City, Turkey, Puerto Rico, Taiwan, Greece, Armenia, Columbia, Mexico City, and elsewhere, it was apparent to IST-A members that locating and extracting all the victims from the Pentagon collapse might require as much as two weeks of nonstop, round-the-clock operations by at least four 68-person US&R Task Forces (two assigned to day operations, two assigned to night, in twelve-hour rotations).

They also recognized the effects of the intense fire caused by the jet fuel aboard Flight 77, and the loss of structural stability when the aircraft plowed through the fifth (outer) ring of the building (obliterating columns and other support structures on the first and second floors). It was clear that the survivability profile for any victims in the collapse was not "high", but also that there was the potential for live victims to be trapped in some hidden *survivable void space* deep within the collapse.

The main collapse area, in the "front" of the building, was identified as Division A, with the standard ICS assignments of Divisions B, C, and D made in a standard clockwise sweep beginning with Division A. The IST-A determined that the main objective of the US&R Task Forces was to locate and extricate an unknown number of victims from within the large combination "lean-to/pancake" collapse in Division A that involved five heavy reinforced concrete floors topped by a two-foot thick concrete roof--without causing additional casualties. It was evident that the combined effects of the plane crash, a massive fuel-fed fire, and subsequent collapse would essentially require "re-engineering" of the Pentagon's first and second floors in Divisions B, C, and D. This would be accomplished through a massive and innovative shoring operation conducted by the US&R Task Forces with coordination by the IST *Operations Officers*, with direction from the IST *Structures*

Specialists, specially trained structural engineers experienced in advising US&R task forces engaged in collapse disaster operations, and the IST *Urban Search and Rescue Specialists*, whose role at this disaster was the equivalent of Division/Group Supervisors.

It was apparent that there was a need to reduce the potential for secondary collapse and "overhead hazards" before committing personnel into the main collapse area. It was evident that it would take at least a week to locate and remove all victims, even with the commitment of 4 FEMA US&R Task Forces, three local technical rescue teams, and hundreds of local firefighters, military personnel, and heavy equipment resources.

Collapse Search and Rescue Operations

Viewed from a distance (or from television news cameras, whose location was restricted to a distant site outside the Pentagon grounds due to security concerns), the 80 foot-wide gash and the fire and smoke damage to the west face of the Pentagon—the only obvious external signs of damage—might mislead observers to conclude that the damage was confined to the collapse itself. But in truth, damage to the structure and contents--and the carnage--were far worse and more extensive than could be seen from outside the Pentagon. Hidden within the building was the back of a 240-foot-deep, five-story collapse zone. Surrounding the actual collapse were hundreds of feet of damaged building whose columns and supports had been blown out, burned, or otherwise damaged, and whose floors were badly sagging and subject to secondary collapse with very little prompting. In terms of size and complexity, some FEMA US&R task force members at the Pentagon likened the collapse problems to those they encountered at the Oklahoma City bombing.

US&R operations at the Pentagon relied on the five standard phases of structure collapse search and rescue (U.S. system): Size up and Recon (Stage 1); Surface Rescue (Stage 2), which includes the Primary Search; Void Space Search (Stage 3), which includes the Secondary Search; Selected Debris Removal (Stage 3), which includes carefully dissecting the building with heavy equipment and rescue personnel and looking for live victims and the deceased; and General Debris Removal (Stage 5), including the clearance of all material using heavy equipment and other methods. It should be noted that the international system of structural collapse SAR includes a sixth stage, *Control of Utilities.* In the U.S. system it's assumed that the Incident Commander and the Officer in Charge will ensure the utilities are addressed as a matter of course. This is a minor difference between the U.S. and international systems; the other stages of collapse search and rescue are essentially the same.

Each FEMA US&R Task Force consists of 68 persons who make up four 6-person Rescue Squads, two 2-person Technical Search Squads, four Canine Search Teams, two Medical Squads, and specialists in heavy equipment, logistics, communications, structural engineering, technical information, and hazardous materials response. They are organized under the following "Team" within the task force, each with a primary and assistant Leader[4]: Search, Rescue, Medical, and Technical. Each position on the US&R Task Force is duplicated, in order to allow round-the-clock operations.

Because of the magnitude of the disaster and the limitations imposed by the damage caused by the aircraft going through the building, thousands of square feet of space in the fire-affected areas of all five floors remained chest-high in incinerated debris. This would require a third round of thorough searching by hand, in order to ensure that no bodies (or parts of bodies) were left behind or would end up in dump trucks during Stage 5.

From Day One it was clear to engineers (Structures Specialists) attached to the IST and the US&R Task Forces that a major stabilization operation was required to prevent

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4 There are two Leaders for each Team within the task force, in order to support the task force splitting in two to take turns working 12-hour shifts, thereby ensuring round-the clock US&R operations.

Division B and parts of Division C and D from collapsing and burying rescuers in Division A, where the combination lean-to/pancake collapse had occurred.

And there was another complication: The two-foot-thick concrete roof structure topping Division A. Because of the angle of the lean-to collapse, the concrete roof appeared poised to start a massive "slide". With no easy access to conduct inspections below the roof, the engineers were unable to determine exactly what was holding it in place. Some of the Structures Specialists suspected that only a small number of rebar strands might be connected, while others postulated it might be a combination of inertia and internal connections between the collapsed and "uncollapsed" sections of the building. The engineers were concerned that the entire upper deck might "avalanche" into Division B, much like a layered cake slides in layers if tilted sufficiently. Such a cascade of hundreds of tons of material striking Division B might, in turn, cause that part of the structure to fall back onto Division A.

Because of the intense fire that raged for half a day on September 11, the survivability profile for victims trapped in the Division A collapse was considered relatively low (in comparison with collapses where there was no fire and where survivable void spaces were more likely to be found). Still, no one discounted the possibility of live, viable victims buried somewhere deep in the collapse where they would be neither seen nor heard until the upper layers of the collapse were removed. But first certain areas of the building needed to be shored up to prevent secondary collapse that could kill rescuers and seal the fate of any victims who might be awaiting assistance somewhere in the collapse. And there was also the issue of the roof, which appeared ready to avalanche into Division B. The IST members decided it would be most prudent in this case to properly shore Divisions B, C and D before committing personnel to penetrate and "de-layer" Division A until the most vulnerable portions of Divisions B, C and D were properly supported, and until they figured out a solution for the roof.

Early on, the US&R Operations Plan specified that the initial efforts would include the beginning of a massive shoring operation on Floors 1 and 2 of Division B, at the same time that other US&R Task Force Rescue Squads and Search Teams conducted a thorough and methodical Secondary Search of the upper floors looking for victims who might have been missed during the firefighting operations. Although dozens of bodies had been located and marked for later removal in various parts of Divisions B, C, and D, approximately 150 more people were unaccounted.

Stabilization Operations

In US&R, a generally accepted strategy for shoring large unstable buildings is to work from the unaffected areas of the building toward the affected area. This allows rescuers to stand in relatively "safe" areas, and methodically work their way into non-shored areas that would otherwise be unsafe to enter. This was the approach adopted at the Pentagon. The US&R Rescue Squads began at the front of Division B and constructed a variety of shores to replace missing and damaged structural columns. As they worked their way into the building, they built a kind of "forest" consisting of immense shoring combinations to support damaged and broken beams.

In order to reach each spot where shoring was to be placed, rescuers methodically worked their way from a shored area to a non-shored section, placing temporary shoring in the form of pneumatic pipe shores and other short-term measures. Working by hand and with hand tools, the Rescue Squads removed tons of debris, locating bodies and body parts (which were documented "in situ" by the FBI teams and removed by military teams once they were accessible). When a section of slab of sufficient size was cleared down to "clean" concrete, a base was built and the shoring went up. It was painstaking work, requiring rescuers to cut and remove tons of debris and pass it out "bucket brigade" style.

Tons of lumber, cut to specified dimensions by Cutting Teams that had been established outside the building, were passed into the building in the same manner. The Rescue Squads called out the required dimensions, which were relayed to the Cutting

Teams, who quickly sized the timbers and cut them to the specified dimensions. Within one day, a virtual shoring factory had been established, complete with its own lumber yard that was constantly restocked by fleets of local lumber trucks, as well as various cutting stations built on the site to expedite the sizing of shoring lumber. .

Essentially, the affected parts of the Pentagon were "re-engineered" by the firefighters and US&R Task Forces and Teams, in order to affect the removal of all victims and to provide for a relatively safe crime scene investigation.

Recovering the Deceased

The following approach was applied to the recovery of Pentagon Incident fatalities: When a victim was located, work in the area was halted to protect the body, personal belongings, and evidence. An FBI evidence team (one of several on constant standby in front of the collapse) would document the site and gather evidence. If physical extrication was required, a Rescue Squad from the assigned US&R task force was given this task. The next step in the process was a Military Mortuary Team who collected and removed the victim from the building.

The US&R Action Plan

The US&R Action Plan was coordinated with the Pentagon Incident Action Plan. Liaisons had been established between the IST, the ACFD, and the other agencies with roles in the collapse search and rescue operations. The IST Leaders and Operations Chiefs consulted with Pentagon command about all major US&R issues, in order to ensure that the ACFD chiefs would not be surprised, and so ACFD personnel could keep the appropriate decision-makers (as well as the news media) accurately informed about progress of the operation.

US&R-related problems were addressed rapidly and jointly by the IST and Pentagon Command, and solutions were generally arrived at by consensus. As the incident progressed, some observers commented that the Pentagon Incident was an example of how a major terrorism event that results in a major firefighting/hazmat/mass casualty/WMD/US&R/investigatory response, can be effectively managed.

A written US&R Action Plan was produced for each 12-hour operational period. The plan was constantly updated to reflect the current conditions, the progress being made, problems being encountered (and solutions to fix them), strategic and tactical goals for the next operational period, and factors such as anticipated weather and the security conditions. It included a US&R Operational Plan; a US&R Communications Plan that identified the frequencies being used; Safety Plan for US&R operations; a Medical Plan covering the specific tasks being performed by the US&R resources; a Rapid Intervention Plan for US&R operations, a Shoring/Stabilization Plan, and other elements. The Plan was published every 12 hours and distributed to all US&R elements prior to each Operational Period, and it was reviewed at the IST Operational Briefing prior to the start of each Operational Period

Under direction of the IST, the FEMA US&R Task Forces and other US&R resources were engaged in major round-the-clock shoring operations to prevent the Division B side of the building and parts of Division C and D from collapsing and burying rescuers when they began working to search void spaces and "delayer" Division A, where the combination lean-to/pancake collapse had occurred.

It took several days to "re-engineer" these areas of the Pentagon in order to allow rescuers to proceed with de-layering and searching void spaces (including Canine and Technical Search teams) in the main collapse area. In fact, shoring operations continued in various parts of the Pentagon until September 21, even as the rest of the building was being de-layered.

The US&R Task Forces methodically worked their way from shored areas to a non-shored section, placing temporary shoring in the form of pneumatic pipe shores and other

short-term measures. Working by hand and with hand tools, the Rescue Squads removed tons of debris, locating bodies and body parts that were documented by the FBI and removed by the Military teams. When a section of slab of sufficient size was cleared down to "clean" concrete, a base was built and the shoring went up. Outside the building, many tons of lumber were cut to dimensions requested by the shoring teams. Cutting Teams had been established in front of the structure, and the timbers were passed into the building "bucket brigade" style, 24 hours a day.

"Sectioning" the Roof

The roof above the collapse presented a significant danger to rescuers. Because of the angle of the collapse, the concrete roof over Division A appeared poised to start a massive "slide" in Division B. The instability of the collapse prevented engineers from inspecting below the roof, so they were unable to determine what was holding the concrete deck in place. They were unsure what was connecting the roof to the rest of the building. They were also concerned that the entire upper deck might "avalanche" into Division B, which in turn might cause part of the structure to fall back onto Division A. On the evening of September 12 the IST held a meeting to discuss solutions for the roof structure. It was agreed that one possible solution was to break up the concrete deck into manageable sections that could be lifted off with cranes in a controlled manner to prevent the whole thing from avalanching. One of the Structural Specialists recalled a type of heavy equipment with combination "concrete pulverizer" and "shear", which swivels 360 degrees on the end of an articulating boom. It has the ability to pulverize concrete slabs, pinch large pieces of slab between a sort of metal "thumb and forefinger", and even to grasp steel I-beams to "sweep" debris from a rubble pile.

Within hours the machine was found operating at a construction site in Baltimore, operated by the firm of Potts and Callahan Construction. It was a *Catepillar 345 Ultra-High Reach Excavator* with an *M.P. (multi-processor) -20 Pulverizer and Shear.* Because of the size an appearance of the excavator, it was known by euphemistic description as the *T-Rex.* Plans were made to get it to Washington D.C. with a code 3 police/state trooper escort directly to the Pentagon.

Meanwhile the US&R Task Forces continued shoring around the perimeter of Division A. By the afternoon of September 13 the T-Rex was sitting in front of the Pentagon, ready to operate.

Heavy Equipment Operations for Access by Selected Debris Removal

The Heavy Equipment and Rigging Specialist attached to the FEMA US&R Task Forces were responsible for interfacing with local heavy equipment and crane operators, educating them about their role in the search and rescue process at the site, and informing them about their place in the Incident Command System. Throughout the incident, Heavy Equipment and Rigging Specialists from the FEMA US&R task forces played a vital role in maintaining safe and effective operations by ensuring that the heavy equipment operators worked in concert with the Operational Plan and with the rescuers inside who were carrying out the operations.

As the T-Rex went to work on the evening of September 14, the US&R task force members were pulled out of the vulnerable parts of the Pentagon and assigned to assemble a safe distance from places vulnerable to secondary collapse from the work of the multi-processor. The Task Forces continued to operate in the building, continuing their massive shoring operation on Floors 1 and 2 of Division B and elsewhere, and conducting a methodical search of the upper floors looking for victims who might have been during earlier sweeps. But they were kept out of the areas thought to be most vulnerable to secondary collapse if the Division A roof were to avalanche into Division B as a result of the T-Rex's work.

The T-Rex began dissecting the 2-foot thick reinforced concrete slabs, carefully picking up each piece and picking it off the top of the collapse zone, finally depositing each

piece on the ground or in a dump truck. Coordinating with the IST Structures Specialists and Heavy Equipment/Rigging Specialists from the US&R Task Forces, the operator was able to pulverize the slab at will, then "grab" large pieces and place them wherever he chose (within the reach of the articulating boom.

With the T-Rex in operation, it quickly became apparent that the Division A collapse area could be delaminated and dissected far more quickly than if US&R Task Force members were cutting the slabs by hand and rigging and slinging them for lifting by cranes, or attempting to tunnel vertically through the slabs.

One issue related to the T-Rex was the limitation imposed by the operator's own line-of-sight vision, complicated by debris, fatigue, and darkness that inhibits a human's depth perception. As the operation proceeded around the clock, it was increasingly difficult for the operators to discriminate debris from bodies trapped within it, in part because everything began to take on the color of concrete dust. It was also necessary to provide instant guidance regarding which pieces of the building could safely be cut and removed, and in which order, to prevent secondary collapse and other safety hazards.

Recognizing this, the IST established a 24-hour Lookout for victims, evidence, and signs of secondary collapse. Each Lookout crew consisted of one US&R Task Force Search Team member and one Structures Specialist stationed in a "man lift" basket suspended high above the Pentagon beneath a 200 foot crane that was stationed directly in front of the Pentagon for this purpose. The lookout crews were rotated periodically to ensure they remained sharp and alert. It was their job to constantly look for victims in the rubble, to spot potential safety problems, and to communicate them to the heavy equipment operators. This avoided situations where deceased victims might have been mistaken for debris and picked up or loaded into dump trucks by heavy equipment, and where secondary collapse caused by the machines might endanger other rescuers.

The only exception was when a secondary collapse occurred on the evening of September 15 while the T-Rex was working. The collapse was significant, but it was controlled through the quick actions of the T-Rex operator, who slowed the avalanche of material as it headed toward Division B. Fortunately, the shoring held and there was no additional loss of life or injuries from this potentially lethal event. Given the constant potential for major secondary collapses throughout this incident, it's a tribute to the skill of the heavy equipment operators and the effectiveness of the shoring operations in Divisions B, C and D, that only one significant secondary collapse occurred during the entire twelve days.

De-layering and Void Space Search Operations Continue

The "de-layering" of Division A required a mixture of *selected debris removal* and *void space search* strategies. As the building was dissected by the T-Rex and a "Grapple Excavator", there was a constant watch for victims, their remains, and void spaces that might contain additional victims (potentially live ones). The observers were watching from the ground as well from man lifts suspended above the Pentagon. Members of the US&R Task Force Search Teams were stationed in strategic locations where they could watch the building and each load of debris being deposited on the ground in front of the Pentagon. They were on the lookout for any sign of victims unburied in the collapse, in which case all operations there would cease and personnel would identify the object/remains and determine whether further extrication work would be needed to free it. They were also watching for signs of remains being deposited with debris on the ground.

Periodically new void spaces would be opened up during the de-layering process. For every new void space, US&R Task Force Search Team members physically searched every accessible void area for victims, crawling into them when possible. They used *Snake* Eye and *Search Camera* remote search devices, *Trapped Person Locators*, search dogs, and direct visual and voice contact to search for victims trapped within void spaces encountered. Some of the deceased victims were mostly intact, in void spaces that might

have offered a chance of survival had it not been for the intense fire that raged there during the first 36 hours of the disaster.

When deceased victims were discovered in void spaces, the Search Teams would pause to call for the FBI to document the scene. Then a Task Force Rescue Squad would come in to shore the area, breach floors or walls, cut rebar, and generally make the victim ready for removal. The FBI agents would take gather additional evidence before the victim was removed, and the Military morgue detail would make the actual extraction by hand.

After the deceased victim was removed, the T-Rex would move back into place, dissect the building to the limits of its reach (or until a floor had been removed). The T-Rex would pull back, allowing the *grapple excavator* to move into place to remove debris that had fallen from the collapse, and to eat its way further into Division A. The *grapple* would deposit materials on the ground in front of the Pentagon for further searches, then move out to allow the pulverizer to come back in. These rotations sometimes took hours…a meticulous process that continued around the clock for nearly a week and a half.

Debris Search Operations

All the debris removed from the building was spread out by the heavy equipment, and (on the signal of the IST US&R Specialist) the equipment would stop and Canine Search Teams from the US&R Task Forces would deploy across the material in search of any scent indicating human remains. Then US&R Search Team members would conduct a physical search for remains, crawling and walking over all the debris. Finally, after being searched three or more times, the debris would be loaded into trucks with skip loaders, where it would be taken to one of the Pentagon parking lots to be further combed for human remains and evidence by the FBI, ATF, Military units, and the Arlington Police Department.

The strategy of alternating *void space searches* with *selective debris removal* continued until the entire collapse zone had been dismantled and all victims were located and removed. Heavy equipment was used to expedite the removal of hundreds of tons of rubble in a safe, effective manner. Structural Specialists from the IST and US&R task forces made critical decisions about removal, breaching, shoring and cutting of large debris throughout the operations.

FEMA US&R Task Force Search Team Managers established a canine search plan for each operational period, they evaluated requests for canines to search portions of the building as operations progressed, they kept the search dogs operating at their optimum by establishing rest periods and other essential actions, and they generally looked after the welfare of the dogs. One of the IST priorities was to assure safety for the Canine Specialists and dogs, who often found themselves working in some of the most precarious positions.

The strict attention paid by the IST US&R Specialists and Safety Officers to safety aspects of the canine search function allowed the dogs and handlers to concentrate more fully on the actual search, knowing that their welfare was being attended to. Their knowledge of structural issues, search methodology, and other aspects of the operation was an important factor.

As the days went by, this process was streamlined in order to find the most remains in the most timely manner, to prevent its deterioration and loss, to allow for better identification, and to reduce the time families would have to wait for word on the ultimate fate of their loved ones. The operations of the heavy equipment (T-Rex, *grapple*, skip loaders, dump trucks) and the personnel (US&R Task Force technical search teams, canine search teams, and physical search teams) were choreographed “assembly line style” by the IST Operations Chiefs with support from the US&R Specialists, the Heavy Equipment and Rigging Specialists and the IST Structures Specialists, in order to shorten the time of discovery of victims and the removal of debris in order to find more victims.

Canine search teams were used extensively throughout the operation and proved extremely accurate in pinpointing the location of victims buried in the rubble. This helped

the rescuers pinpoint their efforts in on critical areas for rescue/recovery, and reduced danger to rescuers by limiting their exposure to "victimless" areas.

In at least one case, a victim found trapped in the collapse could not be freed without severely endangering the lives of rescuers due to the potential for secondary collapse threatened to bury them. After deliberating, the IST and US&R Task Force members decided that the most prudent course of action to protect the lives of rescuers and still recover the body would be to perform a surgical amputation of the deceased victim's shoulder, which was pinned beneath dozens (perhaps hundreds) of tons of reinforced concrete slabs and material.

A Medical Team Manager (Emergency Room Physician) from one of the US&R Task Forces was selected to perform a surgical amputation, which was completed without delay. The trapped arm and shoulder were covered and marked with fluorescent orange spray paint and flagging tape in order to ensure rapid location and recovery after the debris was "de-layered" from around it. Later, the remains were reunited in the same manner previously described, and sent along for autopsy and identification.

Operations Near Completion

As the operational area size was cleared of victims and evidence and reduced through combination Stage 3 and Stage 4 operations in Division A, combined with ongoing Stage 5 operations in Divisions B, C, and D (as well as continued shoring operations as the building was de-layered), by September 18 it was recognized that the need for 4 full FEMA teams no longer existed. Recognizing this, the IST developed a plan to relieve the first two FEMA US&R Task Forces to arrive (VATF-1 and MDTF-1), and to work one Task Force on both the day and night shift.

A fifth US&R Task Force from New Mexico (NMTF1) was activated to provide new manpower for the balance of the Pentagon Incident. By September 20 it was decided to demobilize MDTF-1 and TNTF-1, as the physical work load had been reduced to a level manageable by a single US&R Task Force and the local technical rescue teams. Therefore, NMTF1 and the WMD & local teams were split into Day and Night Operations.

On the evening of September 21, the IST advised Arlington command that all areas of the building had been search several times, all shoring operations were complete, and that the US&R goals had been met. It was agreed that at 0800 hours on Saturday September 22, all search and rescue efforts would cease, and the FBI would assume responsibility for on scene command and control to complete their crime scene efforts.

Thus came the end of the second most deadly terrorist attack in U.S. history. Just four hours away, thousands of rescuers continued to toil round-the-clock in a desperate search for thousands of citizens and more than 300 firefighters missing at World Trade Center collapse.

What We Learned

In a disaster of such a magnitude of tragedy and duration, there are too many lessons to list in one place. What follows is an attempt to capture some of the most pressing lessons that might be applied at future collapse disaster operations, including those resulting from terrorist attacks.

1. Local fire/rescue agency chiefs and officers will be at a distinct advantage in future disasters if they are familiar with the Federal Response Plan (including ESF-4, ESF-9, etc), the FEMA US&R Task Force System, the FEMA IST concept, and if they have developed local plans to integrate these vast and highly experienced Federal resources seamlessly in the event of a large or complex disaster like a terrorist attack, earthquake, flood, or structural collapse. Even company officers (who may be in charge of certain scenes during the course of large-scale disasters) should be familiar with these plans and resources. Information about the Federal Response

Plan and the FEMA National US&R Response System may be obtained from a number of sources, including the official FEMA web site (www.FEMA.gov/usr), regional FEMA offices, and state offices of emergency service.

1. Collapse SAR operations related to earthquakes and terrorist attacks frequently last days or weeks. They require round-the-clock operations to locate and extract all victims within the window of survivability, and to recover the dead in a timely manner. Emergency officials should be planning to pull live victims from the rubble up to three weeks after catastrophic earthquakes, and they should be prepared to sustain nonstop search and rescue operations until all hope of locating viable victims has passed. The public has the right to expect this level of response to devastating quakes in the U.S.

   One advantage of FEMA US&R Task Forces is that they are designed to conduct nonstop operations without a great deal of local support. Each Task Force is prepared with sufficient food, water, and supplies to operate for 72 hours without resupply. One of the initial functions of the IST is to establish resupply the US&R Task Forces in order to continue a mission indefinitely, without requiring anything of the local jurisdiction. This level of self-sufficiency is critical in large disasters because it reduces the impact on local agencies that have their hands full dealing with the disaster itself. Another advantage is the tremendous amount of collapse search and rescue (and overall disaster rescue) experience that FEMA US&R Task Force members bring to an incident. Still another key advantage is the US&R Task Force mission of supporting the local I.C.'s incident objectives, which keeps the local Incident Commander in charge, yet provides him with an advanced Federal US&R capability that may becomes part of his command and operational structure, depending on the local I.C.'s needs.

2. Generally, all five stages (six stages in the international US&R system) of structure collapse rescue should be conducted, in order. But sometimes the Incident Commander must mix the stages based on the specific conditions of the disaster. For example, skipping Void Space Search and going directly to General Debris Removal may—in some cases--doom live victims (who might be trapped within collapse zones but undetectable from the surface) who might otherwise be saved alive. In other cases, a combination of multi-stage operations must be applied. The bottom line is that--with few exceptions--all five stages of collapse rescue should be accomplished at some point in the operation, depending on the specific conditions encountered and the availability of specialized resources.

3. In large-scale or complex collapses, it may be necessary to simultaneously conduct various Stages of Collapse Rescue. In the Pentagon, Void Space Search was happening in one section of the building while Selected Debris Removal was occurring in another. One of the advantages of the FEMA US&R IST is that the I.C. can assign coordination of large-scale collapse rescue operations to it (e.g. create a USAR Branch with the IST Leader as the Branch Director, or assign the IST to supervise a Rescue or USAR Group), with confidence that the IST can coordinate and manage multi-Stage collapse operations.

4. In all of the disasters to which they have been assigned by FEMA, the US&R Incident Support Teams have demonstrated that they are "in their element" when they are assigned to manage multiple simultaneous collapse SAR operations involving more than one FEMA US&R Task Force at major disasters. It is a positive sign that these teams, consisting of selected members of US&R Task Forces from around the nation, can be dispatched within minutes of a disaster and arrive from every corner of the U.S., and function as an effective management team to help coordinate and maximize the efforts of the US&R Task Forces to help rescue trapped people who might not otherwise survive a disaster.

5. The U.S. Federal Response Plan works. Nothing is perfect, but this system has proven itself to be highly effective in cases of large-scale disasters involving trapped people. This was evident at the Pentagon disaster, where FEMA activated four US&R Task Forces to Washington (as well as a dozen more US&R Task Forces to New York) within one hour of the terrorist attacks; and where a plethora of Federal resources supported the needs of the local and state agencies in charge of handling the consequences of the attack. This operational efficiency was equally evident at the Oklahoma City bombing, at the Northridge earthquake, and a number of other disasters around the U.S. in recent years. While there is always room for improvement (and recognizing that efforts are underway at this time to further streamline the system), the Federal Response Plan and the National US&R Response System are two of the true success stories of the U.S. Federal government.

6. The FEMA National Urban Search and Rescue Response System has successfully fulfilled the mission given in 1989 to develop and operate a nationwide network of disaster urban search and rescue resources that can be deployed within hour and operate nonstop for days or weeks to ensure the best chance of survival for trapped victims. The FEMA US&R system has proven itself repeatedly at disasters ranging from hurricanes to earthquakes to floods to terrorist attacks since its inception. The system works as it was designed, fulfilling the U.S. Federal government's promise to provide timely and expert response to collapse-related disasters and other disasters that leave people trapped anywhere in the United States or its territories.

7. The FEMA National US&R Response System is **expandable.** The mission of this system had already been expanded to include Weapons of Mass Destruction response before the 9-11 attacks. This is one reason why FEMA US&R Task Forces have been strategically deployed at the 1996 Atlanta games and the 2002 Winter Olympics in Utah, as well as other events of national and international import. In recent years there have been hearings to explore to possibility of expanding the role of the National US&R Task Forces to cover flood rescue operations and other disasters involving trapped people.

   It's becoming clear that the Federal US&R Task Forces can be effectively deployed to augment local resources during disasters involving floods, mud & debris flows, dam failure, and even unusual events like volcanic eruptions and tsunamis.

   In California, all eight of the Federal US&R Task Forces have already been equipped and trained for flood rescue operations (part of an initiative by the California Office of Emergency Services), and these US&R Task Forces have already been successfully deployed to rescue people during flood disasters in the Sacramento area, in Yosemite National Park, and elsewhere. The Pennsylvania US&R Task Force participated in the rescue of hundreds of people during flooding that accompanied a recent hurricane. These efforts demonstrate that the US&R Task Forces, properly trained and equipped and deployed in a timely manner, can effectively augment local, reqional, and state swiftwater rescue capabilities during large flood disasters. It's a tribute to the logic of those who saw the need to establish the state and FEMA US&R Task Forces.

8. Fire, heat, and smoke from the jet fuel-stoked fire killed many occupants of the Pentagon who might otherwise have survived the initial crash of the 757 airplane into their building. If not for the fire, it's quite possible that live victims might have been located and rescued from the collapse of Division A in the days following 9-11.

9. As a matter of principle, rescuers should assume—until proven otherwise--that there may be live victims in a collapse event of the size and nature of the Pentagon Incident. Victims should not be "written off" until their survival has been demonstrated to be impossible because of conditions like intense fire, lethal radiation (e.g. "dirty bombs") or non-survivable submersion.

10. The decision of FEMA to immediately mobilize IST's and US&R Task Forces to the Pentagon and World Trade Center disasters was prudent and provided an added layer of protection to trapped victims and rescuers alike. They did it without delay, and even without some of the paperwork that is normally required. It is this type of pro-active approach to disasters by FEMA and the ESF-9 cell that will help save lives and provide additional protection for local firefighters and rescuers in future disasters, and it should be applauded by the nation's fire and rescue services, as well as by the politicians, the news media, and the citizens who benefit from this fast-response approach.

11. One of the critical needs in a collapse disaster is to prevent secondary collapse that kills or traps rescuers. The response of FEMA US&R resources helped ensure this need was met. When one considers the potential for secondary disaster at the Oklahoma City, World Trade Center, and Pentagon attacks, and that not a single rescuer was killed while conducting search and rescue operations in the aftermath of these events, it becomes clear that the FEMA US&R System (which was, after all, designed by the nation's collapse rescue experts, including Ray Downey, Chief of the FDNY Special Operations Command, and others with decades of experience managing large collapse disasters) is an effective means of ensuring rescuer safety and effective urban search and rescue operations at disasters of this nature.

12. Based on the resource needs at the simultaneous disasters in New York and Washington on 9-11, it's clear that fire/rescue officials should consider the potential for even larger (or multiple) disasters resulting from terrorist attacks, earthquakes, or other causes, which may require the commitment of all available Federalized US&R resources, and may require the use of US&R teams from other nations.

13. A variety of non-traditional rescue resources proved effective at the Pentagon. The use of tools like the "multi-processor", lift trucks, Bobcats, skip loaders, and man lifts, reduced the time and manpower required to perform many critical tasks, and improved the level of safety for personnel operating in high-risk areas.

14. At major collapse incidents, Incident Commanders are well-advised to consider requesting structural engineers to advise them on the safe mitigation of complex collapse problems. Each US&R Task force and each US&R IST includes two Structures Specialists, civil engineers who are specially trained to help rescuers conduct high-risk USAR operations. This is a huge advantage when developing tactics and strategy, for evaluating the effectiveness of stabilization operations, and for determining the advisability of high-risk tactics. The value of the IST and US&R Task Force Structures Specialists at the Pentagon cannot be overstated.

15. Experience counts. The efficiency with which members of the IST and the various US&R task forces managed to deal with the range of USAR- related challenges presented by this disaster, was indicative of their training and experience. The depth of experience was an undeniable advantage at the Pentagon Incident. This lesson emphasizes the responsibility of participating agencies to ensure--as much as possible--that all US&R task force members are trained and prepared to perform all necessary tasks related to their positions. Clearly, experience is a key component of readiness for unusual missions like the Pentagon and World Trade Center incidents. With that in mind, the single most important thing for some agencies may be a raising of the threshold of real-life USAR/collapse rescue experience among members assigned to these special units.

16. There may be a need in the future to deploy full US&R Task Force Rosters, which are three deep in each position on every task force. Ever since the 1994 Northridge earthquake there has been consideration of the potential need to dispatch all three "layers" of US&R Task Force rosters, in order to "triple" the capabilities of the national US&R system. In disasters of a scale necessitating the mobilization of all FEMA US&R Task Forces, this would allow FEMA to transport additional "layers" of rostered US&R TF personnel, carrying only their PPE and other personal gear, to

bolster the on-scene task forces. Instead of rotating different US&R Task Forces in and out of the scene each Operational period (necessitating the time-consuming process of exchanging TF equipment at each shift change), it would be possible simply to rotate personnel from other "platoons" of the same US&R Task Force. It would also allow equipment from each US&R TF cache to be used in wider operations, by infusing additional personnel from the same US&R TF's.

Such a protocol may be used for earthquakes of a size that devastates large urban areas in such a way as to require the response of all FEMA US&R TF's. Few of us suspected the possibility of a terrorist attack so large as to necessitate the response of twenty US&R Task Forces. But after the events of September 11, we must be cognizant of the potential for one or more simultaneous attacks (or a terrorist attack at the same time as another unrelated disaster) to cause "draw down" of the nation's FEMA US&R Task Forces.

17. There is a need to consider using FEMA US&R Task Forces for disasters that may not have been expected at the program's inception in 1989. Terrorism resulting in a collapse disaster on U.S. soil is the first example of events that were not on the "radar screen" of those charged with developing the FEMA National US&R Response System in the late 1980's. Today, it's important for fire/rescue officials to consider the potential for events that would have been deemed implausible just a decade ago. The destruction of a dam through a terrorist attack, for example, might necessitate the mobilization of FEMA US&R Task Forces to help conduct search and rescue in areas decimated by sudden flooding/inundation in urban, suburban, or rural areas. In the case of dam failure from any cause, people caught near the outer perimeters of the flood may be trapped alive in trees, on homes, on bridges, and within collapsed structures. Likewise, avalanches, landslides, mud & debris flows, and other events may create conditions requiring the mobilization of FEMA US&R Task Forces, or components thereof (e.g. Search & Recon Teams, Search Teams, Canine Teams, etc).

18. One of the keys to the relative timeliness and operational safety (for the rescuers and investigators) of the Pentagon Incident operations was the professionalism and preparedness of the Arlington County Fire Department, and the familiarity of ACFD personnel with the FEMA US&R Task Force System. This was due, in part, to the close proximity of Virginia US&R Task Force 1, based in the neighboring Fairfax County Fire & Rescue Department. Not only was the Arlington command staff familiar with the US&R system, but they were on a first-name basis with members of the FEMA US&R IST and some members of VATF-1, VATF-2, and MDTF-1. It allowed the Arlington County FD to manage a relatively smooth USAR/investigative operation that involved local, Federal, and military resources operating with the highest level of cooperation in a very hazardous environment, with few injuries and no fatalities to responders.

Soon after the five story collapse occurred during fireground operations on 9-11, the ACFD commanders essentially told the Fairfax US&R staff: "You handle the USAR operations, using local, state, and Federal US&R resources, and we'll handle the fire, EMS, and haz mat operations". This early division of labor and responsibility led to a smooth transition to a large US&R operation that proceeded round-the-clock for two weeks.

In this sense, the Pentagon Incident carries this lesson for all fire/rescue agencies: It pays to ensure that all Chief Officers and company officers are sufficiently familiar with the local, state, and Federal USAR systems; and that they are prepared to effectively utilize these resources whenever the need arises. Regardless of whether the disaster is the result of a terrorist attack, an earthquake, or some other event that traps people beneath collapsed structures, it is counterproductive for highly trained FEMA US&R Task Forces (and their specialized search and rescue capabilities) sitting on the sidelines when they could (and should) be utilized to expedite the discovery and extraction of live victims;

to make the scene safer for First Responders through the implementation of time-tested strategies and tactics; to help facilitate the needs of the FBI, ATF, NTSB, and military; and to help ensure non-stop, round-the-clock USAR operations until the last victim is recovered, or until the local agencies are sufficiently recovered to assume responsibility for remaining USAR operations.

19. Modern fire/rescue agencies should give serious consideration for the potential for combined "collapse" and "NBC" Terrorist Attacks. For years some terrorism and experts and fire/rescue authorities have warned about the potential for a terrorist attack that would trap people in collapsed structures **AND** involve the presence of nuclear, biological or chemical agents. This "worst case scenario" could place firefighters in the unenviable position of being confronted with live victims trapped in various places within collapsed structures, yet forced to deal with the effects of NBC agents strategically placed to be dispersed by an explosion or by the collapse itself.

    Some people dismissed the suggestion of dirty bombs and other "worst case scenarios" as preposterous. Others stated flatly that we would simply have to "write off" anyone trapped within the perimeters of such an event (this author strongly disagrees: It would depend on the extent and type of contamination, whether the trapped people had actually been exposed to toxic levels; and whether personnel could safely enter the "uncontaminated" sections of collapse zones, and no one would automatically be written off without confirmation of their actual condition).

20. The criticality of experience and training in collapse disasters cannot be overstated.After the Alfred P. Murrah Building was bombed, quake-seasoned US&R Task Forces were dispatched to assist the Oklahoma City Fire Department. The experiences of the US&R Task Force members told them that somewhere in the three-story mound of debris that encompassed the collapse of the nine-floor Murrah Federal Building, there was a chance that people might still be alive within *survivable void spaces* in sections of the building shielded from the blast wave. As it happened, no survivors were found after the first 24 hours, although search and rescue continued nonstop until nearly the entire collapse area was cleared of debris in one of the most complicated and dangerous rescue operations in U.S. History to that point.

    In retrospect, the absence of survivors after Day 1 of the Oklahoma City bombing was mainly a function of the damaging physiological effects of the blast wave, as well as the particular way that the Murrah Building collapsed in *pancake* fashion after its support systems were blown away and gravity took over. The low survivability of trapped victims following Day 1 should lead no one to conclude that search and rescue operations are futile after the first day of future bombing- or earthquake-induced structural collapses. To the contrary, experienced rescuers understand that long-term survival of trapped victims should be *expected* until determined otherwise by physical or visual examination of potential *survivable void spaces*.

    These principles were applied at the Pentagon collapse, leading to two weeks of round-the-clock US&R operations to give the best chance of survival to any victims who might be trapped alive in the rubble. Although there were no survivors found after Day One, it remains true that anyone trapped alive there would have received the best possible change of rescue, given the current level of experience and technology in the U.S. today. The same approach (with improvements resulting from lessons learned in the 9-11 attacks) will be directed to victims of the next national collapse disaster, regardless of the cause.

21. Effective disaster planning is based upon a REALISTIC assessment of the types of disasters which are possible in a particular locale. It used to be that extensive disaster planning was conducted only in areas prone to earthquakes, hurricanes, floods, tornadoes, and other natural disasters. Clearly, every community needs to reevaluate its exposure to potential disasters, whether natural or man-made.

Based on the events of September 11, the time has come to begin planning to ensure timely and effective response to terrorist attacks that just a few years ago were considered so outrageous as to be beyond the scope of plausibility. This planning should include preparations for the effective management of “worst case scenarios”, not just the ones that we know can be managed with existing resources and experience.

The 2002 National Intelligence Estimate, an annual assessment of U.S. intelligence agencies, states “ships, trucks, airplanes, and other means” are the likely modes of delivery of terrorist weapons of mass destruction in the coming years. According to the report, these unusual delivery methods using common objects are “less expensive, more reliable and accurate, and more effective” for attacks to cause explosions or disseminate biological or chemical warfare agents. It’s also clear that fire/rescue agencies should plan for worst-case scenarios. Disaster planning should include worst-case scenarios (i.e. high-impact time of day, multiple simultaneous events, adverse weather, etc.) to avoid being caught flat-footed. Disaster plans should be intended as "living" documents, subject to periodic updates that reflect the latest intelligence.

22. Local fire agencies affected by disasters should update their pre-attack plans for fire fighting and rescue operations in damaged buildings. Some buildings (like the Pentagon) may need major shoring operations to make them safe for entry, search, and rescue, and to fight fires that may break out *after* the disaster. Fire alarms and extinguishing systems may be inoperable in buildings damaged by explosions and other destructive events. Structures with damaged fire systems may require 24 hour fire watch or evacuation, and some commercial processes and occupancies may need to be closed down until repairs can be made.

23. The Pentagon search and rescue operations placed high demands on tools. It is necessary to consider additional equipment and resources to cut, lift, and break reinforced concrete in future collapse operations at concrete buildings.

24. The FEMA US&R Bases of Operations were secured by law enforcement officials and the military, which was on high alert throughout the Pentagon Incident. This protection was also applied to the off-site lodgings for all US&R elements. It’s a reminder of the importance of proper security for rescue resources, in order to prevent the possibility of theft, sabotage, or secondary attacks.

25. The feeding and other support provided by the Red Cross and other agencies (including many volunteers) was tremendous. This level of support will not always be available in the immediate aftermath of long-term disasters. For this reason, local fire/rescue agencies should be prepared to be self-sufficient, including food and water, for at least 72 hours.

26. It’s advisable for every firefighter and rescuer working in a large collapse site to carry a personal signaling/alarm device (i.e. whistles, boat air horns, PALS, etc) at all times. This will allow them to warn of impending "adverse events" such as collapses, and to call for help if they become trapped.

27. Filtration respiratory filters were in high demand throughout the Pentagon Incident. The filters required changing daily, and the masks themselves required decon every time rescuers left the Red Zone.

28. All personnel were required to be deconned every time they exited the Red Zone. This function was handled by the Washington area National Medical Response Team (NMRT), developed to address the consequences of a Weapons of Mass Destruction (WMD) attack. The Pentagon incident wasn’t exactly the situation for which the NMRT had planned and trained, but it certainly proved its worth in being adaptable to a disaster in which thousands of personnel required deconning every 24

hours. Fire chiefs and other emergency responders and planners would do well to consider the implications of future terrorist attacks and natural or manmade disasters, where hundreds (or perhaps thousands) or firefighters, rescuers, and investigators may require decon every day for a period of weeks or months.

Conclusion

The timely recovery of victims without serious injuries to rescuers can be attributed to a number of factors, including: (1) The Arlington County Fire Department's rapid and effective initial response; (2) The familiarity of local fire commanders with the FEMA US&R Task Force system; (3) The Arlington County FD's readiness to utilize FEMA US&R resources effectively, including delegating responsibility for USAR operations to the FEMA US&R IST early in the incident; (4) Extremely close coordination between local fire commanders and the FEMA US&R IST; (5) Excellent cooperation between the Arlington County FD, the Military, the FBI, the NTSB, the ATF, local and Federal police, and private heavy equipment contractors; (6) The IST's ability to develop and implement an IAP that supported the needs of the Arlington County FD and all local and Federal agencies that were on the scene; and (7) The overall readiness and professionalism of the FEMA US&R Task Forces.

Given the tragic circumstances of the attacks and the incomprehensible number of innocent victims who lost their live on September 11, it can be said that the US&R operations at the Pentagon were conducted effectively and with as much success as could be hoped for. Despite the complications caused by the shutdown of all commercial air transportation for the first week, the FEMA National US&R Response System worked as it had been designed.

Although the cause of the 9-11 disasters were indeed dastardly—a crime against humanity that resulted in the death of thousands of innocent people from more than 80 nations around the world--the Pentagon Incident Commander was able to handle the disaster that literally landed in his jurisdiction without further loss of life.

This was due, in part, to the close proximity of VATF-1 and MDTF-1. It was also a result of rapid on-scene arrival of FEMA US&R IST members (some of whom are Fairfax Fire/Rescue members), who helped pave the way for the arrival and timely engagement of all FEMA US&R Task Forces assigned to the Pentagon. The FEMA US&R Task Forces moved directly into position, deployed their equipment and manpower, established Bases of Operations, and began working without delay.

As a result, the Arlington County fire command was able to concentrate of firefighting, EMS, and haz mat issues, with confidence that the FEMA US&R System was managing the urban search and rescue operations in a manner that met the objective set by the ACFD's Pentagon Incident Action Plan.

END

The Author

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