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THESIS

ANALYZING THE NEED FOR SPECIAL OPERATIONS TEAMS WITHIN THE FIRE SERVICE

by

Trixie G. Lohrke

June 2011

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Fire suppression and rescue is the primary mission of the fire service, but not all rescue efforts entail putting out fires. For this reason, the fire service created special operations teams. Special operations teams are comprised of highly trained members with advanced skills that come at a high cost to fund and operate. Using three Dallas Fire-Rescue special operations teams as case studies, the findings presented are: (1) benefits and priorities of developing subject matter experts; (2) feasibility from the fire service standpoint and practicality of special operations teams in the fire service; (3) special operations teams can complement or support other special operations teams; and (4) the framework for Dallas Fire-Rescue special operations teams is flexible enough for many fire departments to utilize. The conclusion and recommendations of this analysis will challenge fire service tradition. The value innovation of rank-specific organizational reform in special operations teams will save lives and property while reducing recovery costs.

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ANALYZING THE NEED FOR SPECIAL OPERATIONS TEAMS WITHIN THE FIRE SERVICE

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

Fire suppression and rescue is the primary mission of the fire service, but not all rescue efforts entail putting out fires. For this reason, the fire service created special operations teams. Special operations teams are comprised of highly trained members with advanced skills that come at a high cost to fund and operate. Using three Dallas Fire-Rescue special operations teams as case studies, the findings presented are: (1) benefits and priorities of developing subject matter experts; (2) feasibility from the fire service standpoint and practicality of special operations teams in the fire service; (3) special operations teams can complement or support other special operations teams; and (4) the framework for Dallas Fire-Rescue special operations teams is flexible enough for many fire departments to utilize. The conclusion and recommendations of this analysis will challenge fire service tradition. The value innovation of rank-specific organizational reform in special operations teams will save lives and property while reducing recovery costs.

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LIST OF ACRONYMS AND ABBREVIATIONS

AHJ	Authority Having Jurisdiction
ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BATS	Bomb Arson Tracking System
CBRN	Chemical, Biological, Radiological, and Nuclear
CE	Continuing Education
CISM	Critical Incident Stress Management
CO	Carbon Monoxide
COD	City of Dallas
DFR	Dallas Fire-Rescue
DHS	Department of Homeland Security
EMS	Emergency Medical Services
EOD	Explosive Ordnance Disposal
FBI	Federal Bureau of Investigation
FDNY	New York City Fire Department
FEMA	Federal Emergency Management Agency
FTE	Full-time Employees
GPS	Global Positioning System
GSA	General Services Administration
GWOT	Global War on Terrorism
HDS	Hazardous Devices School
HIPAA	Health Insurance Portability and Accountability Act of 1996
HME	Homemade Explosives
HMRT	Hazardous Materials Response Team
HMT	Hazardous Materials Technician
IAP	Incident Action Plan
IDLH	Immediately Dangerous to Life or Health
IED	Improvised Explosive Device
IFSAC	International Fire Service Accreditation Congress
IRS	Internal Revenue Service

ISO	Insurance Services Offices
KSA	Knowledge, Skills, and Abilities
LCC	Life-Cycle Cost
LEPC	Local Emergency Planning Committees
MCI	Mass Casualty Incident
MS4	Municipal Separate Storm Sewer System
NBFSPQ	National Board on Fire Service Professional Qualifications
NBSCAB	National Bomb Squad Commanders Advisory Board
NCTCOG	North Central Texas Council of Governments
NFIRS	National Fire Incident Reporting System
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NSHS	National Strategy for Homeland Security
NYPD	New York Police Department
OSHA	Occupational Safety & Health Administration
PPE	Personnel Protective Equipment
PSA	Psychological First Aid
RIC	Rapid Intervention Crew/Company
SCBA	Self-Contained Breathing Apparatus
SME	Subject Matter Expert
SOC	Special Operations Command
SOCOM	Special Operations Command
SOF	Special Operations Forces
SOP	Standard Operating Procedures
TAP	Temporary Assignment Pay
TCEQ	Texas Commission on Environmental Quality
TCFP	Texas Commission on Fire Protection
TCLEOSE	Texas Commission on Law Enforcement Officer Standards and Education
TPDES	Texas Pollution Discharge Elimination System
TEEX	Texas Engineering Extension Service
UASI	Urban Area Security Initiative
US&R	Urban Search & Rescue

VBIED	Vehicle Borne Improvised Explosive Devices
WMD	Weapons of Mass Destruction

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It is very humbling to be accepted into this prestigious program at the Naval Postgraduate School, Center for Homeland Defense and Security. In return for my experience, it is my goal to be a force multiplier, and push forward with innovative changes to the fire service and acclimatize the culture to the challenging times in which we live. I concur with Dr. Luntz that "terrorism has no boundaries, and neither should efforts to prevent it."

I have numerous people to thank for supporting me throughout my endeavor of research and composing this thesis for publication. My deepest gratitude to my thesis advisor Dr. Kathleen Kiernan for challenging me to deviate from sequestered boundaries into uncommon territory, and my second reader D.C. Battalion Chief John Donnelly—thank you for keeping me on track by constantly putting me through the "so what" test for clarity. My fellow classmates of cohort 0905/0906, the lyrics from a song come to mind, "You're simply the best, better than all the rest…" To my Dallas Fire-Rescue special operations colleagues, I appreciate the extensive discourse and dedication we share regarding special operations teams. To my biggest supporters at home, my friends and family, I am deeply indebted to you for your persistent encouragement that kept me going throughout this masters program. To my husband Rex, thank you for your love and support.

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I. INTRODUCTION

A. PROBLEM STATEMENT

Priorities for the fire service always have been and will continue to be fire suppression and rescue. While rescue is the primary mission of the fire service, not all rescue efforts entail putting out fires. For this reason, the fire service created special operations teams (Norman, 2009, p. 9). Specialized teams of firefighters have been trained and organized within the fire service to respond to high-risk but low-frequency events. Special operations (special ops) teams may or may not respond to fires. A good way to define a special ops team is as any operation other than basic fire suppression that requires specialized training in unique topics such as:

- Urban search and rescue (US&R)
- Hazardous materials response team (HMRT)
- Swiftwater rescue
- Dive rescue team
- Explosive ordnance disposal (EOD)
- Wildland firefighting
- Aircraft rescue firefighting (ARFF) (Norman, 2009)

These teams are often developed and organized when deficiencies are recognized in after action review incident reports of incidents that involved loss of lives.

Special operations teams come at a high cost to fund and operate. The vast majority of fire departments do not generate revenue for the entities they serve; instead, they are dependent upon tax dollars. Therefore, the cost of special operations teams added to the fire service budget increases the cost of the overall operating budget. The demand for changes in fire service response is driven by life-safety measures for the community. Start-up funding can usually be acquired for the development and implementation of special operations teams due to the loss of life, but sustained funding for the teams is relatively nonexistent. Even when the need has been determined and funding established for special operations teams, staffing becomes another issue.

Staffing these teams with specially trained and certified personnel can be challenging due to promotions within the fire service. The fire service is a paramilitary organization, which means personnel can only be assigned to a position equal to the rank they hold. This can limit the number of certified and trained personnel available for vacant positions until more people meet the rank qualification and are certified.

Failure to fund special ops lowers the fire service's life-safety standards for protection within communities. For example, during severe weather events, such as if the roof of a building collapses due to a torrential rainstorm causing flash flooding and trapping victims, basic fire suppression trained responders will be unequipped to effectively rescue victims and further protect the community. This type of incident requires special operations teams like US&R and Swiftwater Rescue.

The equipment used by special teams is just that, specialized tools, instruments, machines, monitors, etc. Special operations personnel and staff must spend extra time consistently training and extensively using this equipment to stay proficient within their specialized discipline. This equipment is costly but required by the special teams to carry out the rescue missions to which they are responding or deployed.

During hard economic times, government officials prioritize public as well as public safety services (Dallas, 2010). When tough budgetary decisions have to be made, government officials may revert to a pre-9/11 mind-set that the job of the fire service is just to put out fires. People who think of the fire service as only putting out fires may see no need for special operations teams. The result often becomes an identifiable pattern of decreased funding for special operations teams, or, worse, they may be placed out-of-service. Reverting back to just putting out fires and ignoring the possibility of a catastrophic event is an attitude that displays an obvious disregard for fire service life-safety standards within the community. Identifying and understanding the psychological implications, ethics, and politics of a disaster that are not factored in fire service budgets require further examination.

Research has shown that the consequences of a terrorist attack, natural disaster, or man-made catastrophe can be physically and emotionally damaging to people and their communities (Concordia University, 2008). Catastrophic events will continue to occur at unpredictable intervals. The fire service's expanded role of deploying special operations teams to catastrophes enhances the critical mission of rescue by rapidly positioning assets and resources within the communities affected. The *National Strategy for Homeland Security* states, "Our first and most solemn obligation is to protect the American people" (DHS, 2007b, p. 1). It has become the duty of firefighters as domestic defenders to respond and meet the needs of the communities within the homeland much like our military defends the homeland abroad.

Catastrophic events have changed the world, and the fire service has adjusted to the changes by maintaining rescue as their number one priority. More than basic firefighting skills are required to successfully rescue people from calamities such as: structure collapse, confined space, trench collapse, hazardous materials exposure, water or swift water. Firefighters that staff special operations teams have experience with all types of emergencies that allow them to improvise for situations that have no standard operating procedures for because these situations tend to be one of a kind. Fire service special operations teams merit further research to determine their importance in the fire service, possibilities for achieving sustainment funding, and examining the investment in the community's safety and security.

B. RESEARCH QUESTION

Could combining special operations in the fire service achieve greater efficiency and stronger homeland security and defense?

C. LITERATURE REVIEW

This literature review identifies issues relevant to fire service special operations. This material addresses special operations' role in the fire service, their capabilities, and relevance. Few sources relate specifically to fire service special operations teams, although there is some research available on military special operations forces (SOF).

There is relevant material found in federal, state, and local government documents relating to strategies, guidelines, or laws, and in articles and research studies. Other sources pertinent to analyzing and understanding risks, as well as funding issues to consider when deciding to implement special operations teams, were reviewed. Sub-literature sources that impact fire service delivery include research on communities' perception of service delivery, psychological effects of catastrophes on the community, and the process of federal assistance approval.

1. Government Guidelines for Response

There are several government documents that outline homeland security roles of first responders' capabilities regarding preparedness and response, with an emphasis placed on lifesaving measures. These documents give responsibility to first responders as they begin laying the groundwork for how the event will be handled. Under these guidelines, the fire service will control the chaos, place resources, and rescue people. It is these mitigation and response actions that will determine the scope, length, and operational periods of the catastrophe.

Completely preventing terrorist attacks and man-made or natural disasters is impossible; therefore, the *National Incident Management System* (NIMS) states that all catastrophes are local, meaning they should be handled at the local jurisdiction level as much as possible, utilizing local resources such as mutual aid (DHS, 2008b). During a catastrophic event, when local and state emergency resources become overwhelmed and a reserve supply of resources is required for continuous emergency response, mitigation, and recovery, the state government turns to the federal government for assistance. The Stafford Act provides the framework for federal resources to be made available to a state requesting emergency assistance in dealing with a catastrophe (Brazan, 2005). The requested emergency resource response will not be immediate. There will be a time-lag between when an emergency declaration is approved, the location of required resources is determined, and resources are deployed to the catastrophic location. It is politicians who make the formal request for emergency assistance, not the commander of the operation. *The 9/11 Commission Report* attributes delays in response to bureaucracies, stating, "It is

hardest to mount a major effort while a problem still seems minor. Once the danger has fully materialized, evident to all, mobilizing action is easier—but it then may be too late" (National Commission on Terrorists Attacks upon the United States [9/11 Commission], 2004, p. 350). As noted above, local and state government officials will have the primary responsibility to continue and manage the emergency response. According to *America at Risk: America Burning Recommissioned*, the fire service will fulfill this role by being the primary responder to all local hazards and closest connection government has to the disaster-threatened community (Federal Emergency Management Agency [FEMA], 2002).

The *National Strategy for Homeland Security 2007* (NSHS) defines homeland security as "a concerted national effort to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism and minimize the damage and recover from the attacks that do occur." (Department of Homeland Security [DHS], 2007b, p. 3). The NSHS further states that "it is our collective duty to provide the best response possible" to any catastrophe (DHS, 2007b, p. 31). This strategy falls within the responsibility of the fire service as first responders to provide the best response possible. The best response possible may require special operations teams.

Local roles and responsibilities can be derived from national strategy Homeland Security Presidential Directive (HSPD) 7 which establishes a national policy for federal departments and agencies to identify and prioritize critical infrastructure and protect it from terrorist attacks (DHS, 2003b). It is the responsibility of the DHS Secretary to "identify, prioritize, and coordinate the protection of critical infrastructure and key resources with an emphasis on critical infrastructure and key resources that could be exploited to cause catastrophic health effects or mass casualties comparable to those from the use of a weapon of mass destruction" (DHS, 2003b, p. 13). HSPD 7 Number 13 outlines the roles and responsibilities of the DHS Secretary and implies that the loss of human life consequence should be given the highest priority in the risk assessment process (Metoeff, 2005, p. 23). This priority of human life consequence parallels the same high ranking position used in fire service risk assessment.

2. Public Perception of Service Delivery

The Essentials of Fire Department Customer Service states that firefighters should always consider how their actions are perceived by the community (1996). Impressions are formed instantly according to firefighters' appearance, performance, and behavior (Brunacini). Communities' perceptions are developed and maintained by direct or indirect experiences that they react from. These perceptions can reflect positively or negatively on the overall image of the fire service (Brunacini, 1996, p. 53).

Miskel claims there is a misconception that the Federal Emergency Management Agency (FEMA) is one of the first responders to a catastrophe (2006, p. 7). Such was the case in Hurricane Katrina, when the distribution of tee-shirts and ball caps with the FEMA logo were given to first responders to wear (Miskel, 2006, p. 127). When media outlets broadcast footage of first responders crawling into collapsed buildings searching for survivors, people got the mistaken impression that FEMA personnel were conducting search and rescue missions (Miskel p. 128). This misconception causes confusion with local communities questioning why local fire service special operations teams are needed if federal teams are available. In reality federal teams are not available for deployment until officially requested through proper procedures and subsequently approved by the appropriate authorities.

Public perceptions concerning fire protection within the community are reinforced by the emphasis on suppressing fires through Insurance Services Offices (ISO) ratings. Through the ISO Public Protection Classification (PPC) program, communities are evaluated and graded on the fire service's ability to suppress fires (ISO, 2006). The ranges of grades are from a Class 1 (which represents superior fire protection) to a Class 10 (which indicates that fire protection does not meet ISO minimum criteria) (2006). Communities pay attention to these ratings because low ISO ratings translate into lower insurance premiums (ISO, 2004). Fire service special operations teams have advanced capabilities to significantly increase live safety and property protection, but unfortunately these qualifications are not factored into ISO ratings.

3. The Role of Fire Service Special Operations

Norman refers to the National Fire Protection Association's *Standard on Operations and Training for Technical Search and Rescue Incidents* (NFPA 1670) to describe technical rescue, which is "The application of special knowledge, skills and equipment to resolve unique and/or complex rescue situations" (2009, p. 6). He further states that technical rescue involves rescuers operating in a hazardous complex environment, using specialized tools or equipment, armed with specialized training skills and knowledge in order to achieve a successful outcome (Norman). The urban environment is where most complex incidents happen requiring the need for urban search & rescue (US&R) teams to search and find a victim before the rescue of the victim can begin (Norman, 2006, p. 5).

Norman reasons that the fire service should be the primary provider for special operations teams because of the two types of incidents encountered: those on fire or which have the potential to ignite, and those without a fire threat (2009, p. 4). The fire service has trained people in the basics of rescue and understands that decreasing the time a victim is exposed to a life-threatening event by rescuing them, the better chances of survival (Norman). Firefighters train daily on a wide range of subjects such as building construction, overhaul of structures, hazardous materials, elevator use, rope and knot-tying skills, and survival techniques that provide them with a broad basic knowledge base (Norman). It is this basic knowledge foundation of firefighters that specialized rescue operations teams can be further trained and established (Norman).

4. Military Special Operations Forces

In Norman's book *Fire Department Special Operations*, he compares the amount of time and effort spent by the fire service and military developing operational plans by quoting this military axiom: "The greatest battle plan in the world is only valuable until the first shot is fired, then it is up to the commanders to recognize conditions that are different and react to the new situation" (Norman, 2009, p. 83). The author theorizes that

emergency response for firefighters is similar to military experiences, in that both deal with a changing enemy and the best designed plans may be insufficient to counteract a particular situation (Norman, 2009, p. 83).

Tucker and Lamb identify four items required for military special operations forces (SOF) to succeed and that offer parallels for the fire service special operations teams:

> The department's leadership must provide guidance for what the team is to accomplish and why;
>
> The teams' leadership will decide how to accomplish the objectives;
>
> The team must have information technology resources, administrative support, and members dedicated to the team;
>
> Members' performance evaluations results should be determined individually and as a group (Tucker & Lamb, 2007, p. 226).

Effective communication between policymakers and SOF commanders is an obstacle according to Tucker and Lamb (2007). Politicians are policymakers that lack the understanding of military special operations (Tucker & Lamb, p. 229). The government bureaucracy between politicians and SOF limits their ability to provide an accurate risk assessment of utilizing SOF (Tucker & Lamb, p. 231) The authors reason that utilizing SOF must be in line with the importance of the mission set forth by the policymakers, "then the goals and restraints of policy must inform operational planning and execution, just as the possibilities and problems of operations must inform policy making" (Tucker & Lamb, p. 231). Policymakers and SOF commanders must learn to trust and understand each other's viewpoint in decision making. The solution offered by the authors to get past communication obstacles is for both parties to participate in realistic scenarios for the approval, conduct, and possible consequences of a SOF stated mission (Tucker & Lamb, p. 231). This realistic scenario solution could apply to fire service first responders and policymakers within their respective regions. This will allow policymakers to better understand risk assessments and capabilities of special operations teams.

The military definition of special operations shows similarities and some distinct differences with fire service special operations. The *Department of Defense Dictionary of Military and Associated Terms* (as amended through October 31, 2009) defines special operations as (Joint Chiefs of Staff, 2001):

> Operations conducted in hostile, denied, or politically sensitive environments to achieve military, diplomatic, informational, and/or economic objectives employing military capabilities for which there is no broad conventional force requirement. These operations often require covert, clandestine, or low visibility capabilities. Special operations are applicable across the range of military operations. They can be conducted independently or in conjunction with operations of conventional forces or other government agencies and may include operations through, with, or by indigenous or surrogate forces. Special operations differ from conventional operations in degree of physical and political risk, operational techniques, mode of employment, independence from friendly support, and dependence on detailed operational intelligence and indigenous assets. (p. 505)

Clearly, the fire service does not have any military capabilities regarding use of force or any reason to conduct covert or clandestine operations. Norman has a theme throughout his book that basically characterizes special operations as personnel dedicated to rescuing victims by overcoming challenges and never giving up. (2009).

5. Psychological Effects of Catastrophe

Most fire service responses to fire suppression incidents will not require mental health crisis intervention services. Norman addresses the point that when vacant building fires are fought from the exterior, there is no need for deployment of a special operations rescue team (2009, p. 157). The author refers to Fire Department City of New York (FDNY) Standard Operating Procedures (SOP) for the use of rescue companies, "1.1 Rescue Companies (RCOS) have a unique mission beyond the normal elements of fire extinguishment. They provide a wide range of services, including the rescue of civilians or firefighters in extraordinary situations, extrication, and victim removal, when their expertise or equipment is required" (Norman, 2009, p. 156). When emergencies exceed

just being a fire suppression event and special operations teams are required for extensive victim rescue, fire service special operations can summons mental health professionals to the scene and assist victims with crisis intervention measures.

The work of Lowry and Lating examines the initial phase of a catastrophe referred to as consequence management and reconstruction phase by emergency mental health professionals, and it is during this phase they are tasked with the psychological rebuilding of communities (2002 p. 98). Immediately, mental health professionals can begin employing the principles of critical incident stress management (CISM) to combat and restore psychological health to the community (Lowry & Lating, 2002). CISM is referred to as "psychological first aid" and can be applied to victims as well as any first responder that may need crisis intervention management (Everly & Mitchell, 2002, p. 17). These measures are designed to intervene and rapidly reduce mental suffering imposed upon victims due to a critical incident. While fire service first responders are in a reactive phase of the incident, they are assisting mental health professionals in a proactive phase of protecting the mental health of the community.

According to an article in *The New York Academy of Medicine* (2005), New Yorkers suffered significantly fewer mental health problems for up to two years after the 9/11 disaster by participating in emergency crisis counseling. Dr. Joseph Boscarino, Senior Scientist in the Academy's Division of Health and Science Policy, stated the study has major implications for the use of emergency mental health treatment following terrorist attacks as well as other traumatic events (2005). He further stated that scientists had been reluctant to conduct research on disaster victims for fear of causing additional suffering (Boscarino, 2005). Boscarino concluded by stating "Based on our current findings, we suggest that crisis intervention services should be considered as a first line of emergency management for those potentially affected by large-scale community disasters" (2005).

6. Risk Assessment and Fiscal Management

Compton and Granito recommend the fire service evaluate risk and plan for necessary resources (2002, p. 39). Risk is defined by the National Fire Protection

Association (NFPA) Standard 1250, *Recommended Practice in Emergency Service Organization Risk Management* (2000) edition, "as the measure of probability and severity of adverse effects that result from exposure to hazard" (Compton & Granito, 2002, p. 39). Since risk assessments are particular to a specific community, results will vary (Compton & Granito). Risks can be identified by losses that have occurred and potential losses (Compton & Granito). The complexity of the risk regarding frequency and severity must be analyzed within the community (Compton & Granito), Once risks are identified and analyzed, they must be prioritized by a classification or level (Compton & Granito, 2002, pp. 41–44). Other potential risk factors that should be considered are:

- Where does the Department of Homeland Security (DHS) rank the city in relation to vulnerability for terrorist targets?
- Are there risks outside of fire suppression and significant to the community that would require specialized technical rescue operations (i.e., hazardous materials, confined space, swift water, rescue diving)?
- How can injury prevention relating to public health reduce the public health care epidemic by preventing and/or reducing debilitating injuries, permanent disabilities, or premature death, further decreasing the expense to the nation's health care system? (Compton & Granito, 2002, p. 50)

The fire service has traditionally been managed by objectives and operational goals with very little emphasis on fiscal management, according to Compton and Granito (2002, p. 168). Fiscal management is:

> …calibrating the use of resources with citizens' perceptions of need; it is managing the financial resources that have been attributed or allocated to the fire and rescue organization in such as way as to ensure that the organization can remain true to its vision, carry out its mission, and achieve its objectives in the context of organizational values. (Compton & Granito, 2002, p. 167)

This concept creates a positive link between the citizens and the fire service by involving them in the governance of planning with local government (Compton & Granito, 2002). It is important that taxpayer dollars are tracked for the financial record, but from the perspective of fiscal management, it is even more important to determine what citizens see as important before directing resources toward an objective (Compton & Granito). The overall objective of fiscal management is providing fire services that

make citizens' lives safer and better (Compton & Granito, p. 167). As the fire service accepts change by establishing special operations teams, a change in the management of fire services is warranted.

When proactive fire departments expand services by implementing special operations teams, they must also consider how to fund and maintain them. Hall and Demitrov examine the life-cycle cost (LCC) theory as a method used to "identify and quantify the costs of achieving and sustaining preparedness capabilities across the nation" (Hall & Demitrov, 2009, p. 1). LCC methodology estimates start-up cost components (i.e., people, equipment, and training), forecasts the annual operating cost, and long-term equipment cost associated with repair, upgrade, or replacement (Hall & Demitrov). The model is flexible due to cost variables and capability components particular to an agency. Implementation of this methodology follows six steps (Hall & Demitrov):

1. Determine the capability elements
2. Identify and characterize capability components
3. Develop LCC variables for each component
4. Develop a cost model
5. Annualize the cost model and identify cost drivers
6. Link the model to national targets and assigned levels. (Hall & Demitrov, 2009, pp. 5–9)

The outcome of the calculations based on the criteria listed above should provide an accurate budgetary cost for operating and sustaining special operations teams.

7. Conclusion

As shown in this literature review, there are multiple issues that require consideration when analyzing the need for fire service special operations teams. While parallels can be drawn with military SOF, there is a distinct difference between military and civilian response actions. It will be local first responders that will respond utilizing their available resources to manage a catastrophic event within the community. Requesting additional resources from the state and federal governments will be made by politicians through disaster declarations.

Conducting risk assessments will be necessary to understand potential risks or vulnerabilities within a community. When risk assessments are completed and the potential for high risk incidents determined, the fire service can enhance their response and protection capabilities by implementing special operations teams. The perception of the community (taxpayers) feeling safe and secure will have an important impact on fire service delivery within communities. The taxpayers' expectations regarding safety and security will have an effect, positive or negative, on fire service budgets.

D. HYPOTHESES

There are multiple issues to consider when analyzing the need for special operations teams within the fire service to respond and carry out the mission of rescuing people from all hazards during any emergency or catastrophe such as:

- Special operations teams are essential to local communities;
- Local first responders must be prepared to respond and sustain continuous emergency rescue efforts;
- Special operations teams are expensive to fund and operate.

Special operations teams are essential to local communities because government guidelines place responsibility on first responders to effectively respond, manage chaos, take command, and deploy and place resources, all while rescuing people. Rescuing victims and saving lives is a priority of the fire service and homeland security strategies. It is the actions of first responders that will determine the scope, length, and operational periods of the catastrophe. The evidence supporting first responder responsibilities and priorities is found in several government documents. The *National Strategy for Homeland Security 2007* (NSHS) defines homeland security as "a concerted national effort to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism and minimize the damage and recover from the attacks that do occur" (DHS, 2007b, p. 3). The NSHS further states that "it is our collective duty to provide the best response possible" to any catastrophe (DHS, 2007b, p. 31). The *National Incident Management System* (NIMS) states that all catastrophes are local and should be handled

at the local jurisdiction level (DHS, 2008b). *Homeland Security Presidential Directive* (HSPD) *7*, section 13 outlines human life as the highest priority when conducting risk assessments (Metoeff, 2005, p. 23).

Local first responders must be prepared to respond and sustain continuous emergency rescue efforts through mutual aid and automatic response agreements with partnering communities because federal requests for assistance will not be immediate. The formal emergency declaration approval process is determined by politicians. Politicians may delay their decision in requesting federal assistance because they want to further evaluate and confirm that the magnitude of the incident will continue to rise requiring federal resources, in the meantime lives are at risk. Other reasons for a federal response being delayed and/or limited include: availability of resources being requested, time factor in locating specialized equipment with operators, and location of the resource to the incident. The evidence supporting the argument that federal request will not be immediate is the *Stafford Act*, which outlines the formal procedures that government officials must follow for requesting federal assistance (Brazan, 2005). *The 9/11 Commission Report* attributes delays in response to bureaucracies when it states: "It is hardest to mount a major effort while a problem still seems minor. Once the danger has fully materialized, evident to all, mobilizing action is easier—but then it may be too late" (9/11 Commission, 2004, p. 350). When or if a federal emergency declaration request is approved, there is a time delay in locating the required resources and dispatching them to the proper location.

Special operations teams are expensive to fund and operate. The cost of special operations teams added to the fire service budget increases the cost of the overall operating budget. Reasons for the high cost to fund special operations teams are risks outside fire suppression and significant to the community require specialized technical training and certification. Evidence for this argument can be found in *Fire Department Special Operations* (Norman, 2007). The author emphasizes the point that the extensive list of special operations tools and equipment are cost prohibitive to put on all fire apparatus (Norman, 2007). He further explains that it requires numerous hours of training for special operations teams to be proficient in the operation of all specialized tools and

equipment (Norman, 2007). The fire service has a limited ability and need, like the military, to train all fire personnel in special operations (Norman, 2007, p. 8); however, the high-risk/low-frequency events that special operations teams respond to require highly trained and certified personnel to successfully complete rescue missions.

E. SIGNIFICANCE OF RESEARCH

The content of this research is relevant to real concerns of the fire service today. The objective is for the fire service to move away from the status quo and ensure optimal homeland security preparedness and response capabilities. The result of this study will provide fire service professionals with an enhanced framework to consider when analyzing the need for and incorporating special operations teams within their departments.

This thesis will provide a clearer and better understanding for the fire service to engage as willing participants in homeland security. This thesis can also provide other national homeland security practitioners and leaders a greater understanding of the fire service's contribution to homeland security. Multiple government documents have been written directing the fire service toward a more prominent role in homeland security and defense. As such, this thesis may be useful to fire service professionals in evaluating how their fire departments rate in the overall homeland security project.

F. METHOD

In order to answer the research question: Could combining special operations in the fire service achieve greater efficiency and stronger homeland security and defense? The first step will be to identify the capabilities and requirements of several special operations teams. The next step will be to analyze the feasibility of combining one or more teams. Recommendations will then be developed based on the analysis derived from this two part methodology.

1. Part I: Analyzing the Capabilities and Requirements of Several Special Operations Teams

This thesis will examine three Dallas Fire-Rescue (DFR) special operations teams as case studies. DFR jointly houses a Hazardous Material Response Team (HMRT), Urban Search & Rescue (US&R) Team, and Explosive Ordnance Disposal (EOD) Team. These three teams were chosen because they each have unique capabilities. These teams also have capabilities not present in many fire departments; they exceed basic firefighting knowledge, skills, and abilities. Each special operations team requires specialized training, tools, monitors, detectors, and other advanced technological equipment. Only approximately 10 percent of fire departments have EOD teams, they are more common to law enforcement (Cox, 2004).

Each team will be investigated according to Dallas Fire-Rescue manual of procedures and standard emergency operating procedures to understand how they are used, how they are organized, and their capabilities. Next, their core training curriculums will be mapped to existing standards; National Fire Protection Association (NFPA) Standards, Federal Emergency Management Agency (FEMA) Standards, International Fire Service Accreditation Congress (IFSAC), or other standards that pertain to the particular team. Core knowledge, skills, and abilities will be defined and charted for each of the teams. The cost of training and the standards will be charted as well. Finally, each special operations team homeland security role will be evaluated using government documents such as the *National Strategy for Homeland Security* and *Homeland Security Presidential Directives*.

2. Part II: Analyzing the Feasibility of Combining One or More Teams

Based on the analysis above, the combination of one or more teams will be explored. In order to analyze the feasibility and value of combining special operations teams, the following parameters will be used:

1. Feasibility from the fire service standpoint and the practicality of special operations teams in the fire service.
2. Whether special operations teams can complement or support other special operations teams.
3. Whether the framework charted for special operations teams is flexible enough for many fire departments to utilize when establishing or maintaining special operations teams.

The first parameter is the feasibility from the fire service standpoint including special operations teams as an enhancement to public safety and the practicality of this endeavor. This will be evaluated by charting the cost of training, type of training required, and looking for redundancy in the core curriculum.

The second parameter considers whether special operations teams can complement or support other special operations teams in a joint effort to accomplish the stated mission. The role of complement or support could be determined by comparing the capabilities of the teams, how they are used, and how they are organized.

The last parameter is whether the framework charted for special operations teams is flexible enough for many fire departments to utilize when establishing or maintaining special operations teams. The charted information should guide departments in assessing whether they could make some modifications for incorporating special operations teams, or if gradually phasing in a special operations team is a consideration.

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II. DALLAS FIRE-RESCUE (DFR) HAZARDOUS MATERIALS RESPONSE TEAM (HMRT)

A. PURPOSE

The purpose of the DFR Hazardous Materials Response Team is to mitigate, contain, and control intentional or accidental releases of hazardous materials in the safest and most effective manner possible (DFR, 2008a, p. 1). The *City of Dallas (COD) Administrative Directive 3-74* designates DFR Hazardous Materials Response Team as the primary responder to hazardous materials releases or spills in the city of Dallas (City of Dallas [COD], 2004a, p. 1). Hazardous materials are just that (hazardous) and are defined in the *Federal Register; 40 Code of Federal Regulations (CFR) Part 302* and hazardous waste is defined in *40 CFR Part 261* (COD, 2004a, p. 2).

B. ORGANIZATION OF HAZARDOUS MATERIALS RESPONSE TEAM

DFR Hazardous Materials Response Team members are certified firefighters and hazardous materials technicians performing dual function roles. The combining of these duties is not uncommon to the fire service; several surrounding jurisdictions in the metroplex have the same type structure. Likewise, all members are required by the Texas Commission on Fire Protection (TCFP) to hold a structural firefighter certification prior to a Hazardous Materials Technician certification being awarded (Texas Commission on Fire Protection [TCFP], 2007a). TCFP is the regulatory authority that enforces statewide fire service standards and provides education and assistance to the fire service as defined by Chapter 419 of the Texas Government Code (TCFP, 2010b).

Prior to hazardous materials technicians' being assigned to the Hazardous Materials Response Team, they are required to undergo an entry medical physical and annually thereafter (DFR, 2008a, pp. 17–18). This requirement meets the medical surveillance program in accordance with federal law, *Code of Federal Regulations 29*

CFR 1910.120 (f) Medical Surveillance, which mandates employers provide medical examinations and consultations to members of Hazardous Materials Teams (Occupational Safety and Health Administration [OSHA], 2010, p. 376).

When the DFR Hazardous Materials Response Team is dispatched to a hazardous materials incident while at the station, the members will respond on the apparatus (Hazmat 03) that carries equipment, instruments, monitors, and tools needed for mitigating a hazardous materials event (DFR, 2008a). In the circumstance that the Hazardous Materials Response Team is at another emergency, such as a working structure fire and a hazardous materials response occurs, fire dispatch will notify the on-scene incident commander of the request for a hazardous materials emergency response (2008a). If the incident commander approves the release of the Hazardous Materials Response Team, fire dispatch will send a replacement structure fire response to the location of the working fire (2008a). The Hazardous Materials Response Team will clear the emergency scene, retrieve Hazmat 03 from the station, and respond to the hazardous materials incident (2008a). If the incident commander feels that he/she cannot release the Hazardous Materials Response Team because they are committed to an integral part of the fire response and rescue efforts, then a mutual aid Hazardous Materials Response Team will be called (DFR, 2008a).

Anytime the DFR Hazardous Materials Response Team is not immediately available for an emergency hazmat response, mutual aid teams from the surrounding jurisdictions can have fluctuating response times due to availability and proximity to the hazmat incident. Nonetheless, the emergency hazmat response will be delayed, increasing the risks to the community and creating further challenges to the mitigation efforts.

Minimum staffing requirements for the DFR Hazardous Materials Response Team is constant manning of 10 hazardous materials technicians and at least one of the 10 must be a hazmat officer (DFR, 2008a, p. 14). The Hazardous Materials Response Team's minimum staffing requirements are derived from several sources and are used in conjunction to determine minimum staffing because hazardous materials response is regulated by numerous laws, standards, codes, and recommendations. A significant

regulation regarding the staffing of the Hazardous Materials Response Team is found in the *Code of Federal Regulations 29 CFR 1910.120* (a) (3) which defines the buddy system (OSHA, 2010):

> Buddy system means a system of organizing employees into work groups in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency. (OSHA, 2010, p. 369)

The risks to hazardous materials technicians are elevated when working in unpredictable immediately dangerous to life or health (IDLH) environments and operating as partners increases the safety factor for each individual. Essentially hazardous materials technicians are responsible for each other's safety and well being, they are obligated to function in pairs and never freelance (work alone).

Furthermore, requirements for emergency rescue procedures for hazardous materials incidents are articulated in the *Code of Federal Regulations 29 CFR 1910.120* (q) (3) (vi) "Back-up personnel shall be standing by with equipment ready to provide assistance or rescue. Qualified basic life support personnel, as a minimum, shall also be standing by with medical equipment and transportation capability" (OSHA, 2006). The OSHA procedures for hazmat incidents are in-line with the emergency rescue procedures of "two in/two out" for firefighters as defined in *NFPA 1500 Standard on Fire Department Occupational Safety and Health Program* when operating in immediately dangerous to life or health (IDLH) environments.

The National Fire Protection Association (NFPA) is an international non-profit organization and leading authority on fire safety, codes and standards, research, training, and education (National Fire Protection Association [NFPA], 2011a). The NFPA sets the standard for *Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents in NFPA 472*. NFPA 472 reinforces the buddy system as stated in CFR 1910.120 as well as competencies for staffing a safety officer, decontamination (decon) officer, and incident commander positions during response missions (NFPA, 2008b).

A hazardous materials response mission for DFR Hazardous Materials Response Team will proceed with the hazardous materials technicians (HMT) being assigned to the following roles (DFR, 2008a):

- One HMT commander
- One HMT safety officer
- One HMT decon officer
- One HMT communications/research officer
- Two HMTs entry team
- Two HMTs rescue team
- Two HMTs paramedics medical team (2008a)

The HMT commander will be responsible for the entire hazardous materials operations throughout the event (DFR, 2008a). If the hazardous materials event is a component of a larger scale incident, the HMT commander will advise the prevailing incident commander on all hazmat issues (2008a). The HMT safety officer is dedicated to monitoring operations of the Hazardous Materials Response Team and ensuring the safety of the operations during the incident (DFR, 2008a). If the HMT safety officer feels that any action or component of the operation is unsafe, it must be reported to the HMT commander immediately and the operation will be suspended (2008a). In case the HMT safety officer feels an action is immediately dangerous to life or health (IDLH), he/she has the authority to stop the IDLH action instantly (2008a). The decon officer is tasked with supervising the decontamination corridor setup and level of procedures required for decontaminating Hazardous Materials Response Team personnel and equipment (DFR, 2008a). The decon officer must have the decontamination area operational prior to the HMT entry team entering a contaminated area (hot zone) (2008a). The HMT communications/research officer will maintain radio communications between the hazardous materials response team and the incident channel to keep the Incident Commander informed of the Hazardous Materials Response Teams' status during the entire operation (2008a). Two HMTs will don the appropriate personnel protective equipment (PPE) and become the primary entry team into the hot zone or hazardous environment to mitigate the incident (2008a). Two HMTs will stand-by, also donning the

appropriate PPE, and become the rescue team for the primary entry team (2008a). Two HMT paramedics are dedicated for the emergency medical monitoring/treatment of the Hazardous Material Response Team only and will stand-by until the incident is terminated by the HMT commander (DFR, 2008a).

C. CAPABILITIES

The DFR Hazardous Materials Response Team has the capabilities to respond to three levels of hazardous materials incidents (DFR, 2008a) The response levels are usually defined by local emergency planning committees (LEPC) in determining the jurisdictions vulnerabilities and capabilities for response and developing a hazardous materials emergency plan (National Response Team, 2001). The level of hazmat event and classification for Dallas is explained in the next sections (DFR, 2008a).

1. Level 1

Level 1 is classified as an incident of limited scope and short duration. The HMRT can mitigate this type of incident with minimal impact to the environment. Evacuation is not necessary and the scene can be returned to its normal pre-incident state before the hazard occurred.

2. Level 2

Level 2 is classified as an emergency which is larger in scope and duration. An emergency has the complexity for potential degrees of risk and exposure of hazardous substances to the population and environment. Additional Dallas Fire Rescue, city resources, or mutual aid may be required to mitigate this emergency.

3. Level 3

Level 3 is classified as a disaster involving mass casualties, fatalities, illness, large scale environmental damage, or the potential threat of significant injuries and/or impact to the environment. The probabilities for a large scale evacuation or sheltering-in-place will need to be determined for immediate health and safety of the population. A

disaster will most likely be of a long duration, exceed the resources the city of Dallas can provide, and will require external resources and assistance (DFR, 2008a, p. 11).

D. STANDARDS FOR CURRICULUMS

The Texas Commission on Fire Protection (TCFP) is the regulatory authority that enforces statewide fire service standards and provides education and assistance to the fire service as defined by Chapter 419 of the Texas Government Code (TCFP, 2010b). In the state of Texas, certification with the TCFP is mandatory for paid fire protection personnel to ensure the safety of fire personnel and compliance of fire departments with state laws and regulations (TCFP, 2007a).

The TCFP provides the certification curriculum for hazardous materials technician in *Certification Curriculum Manual, Chapter Six Hazardous Materials NFPA 472, 2008 Edition* (TCFP, 2010a). The TCFP curriculum follows practically verbatim Chapter VII, Competencies for Hazardous Materials Technicians in the *National Fire Protection Association (NFPA) 472 Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* 2008 edition (NFPA, 2008b). Clearly, NFPA 472 is the source for hazardous materials technician training and education.

The International Fire Service Accreditation Congress (IFSAC) is a non-profit peer-driven organization authorized by the Board of Regents of Oklahoma State University that accredits fire service certification programs and higher education fire-related degree programs (International Fire Service Accreditation Congress [IFSAC], 2010). The goal of this governing body is to increase the level of professionalism in the fire service by verifying that participating programs are adhering to nationally recognized standards such as the National Fire Protection Association Standards (IFSAC, 2005, pp. 1–3). IFSAC has reviewed, approved, and accredited the Texas Commission on Fire Protection's Hazardous Materials Technician certification program (TCFP, n.d.a). The IFSAC seal can be obtained voluntarily for a small fee after an individual has

successfully completed and met the requirements for TCFP hazardous materials technician (TCFP, n.d.a). The benefit of an IFSAC seal signifies one as being trained to higher nationally recognized standards (TCFP, n.d.a).

Continuing education (CE) hours are required annually by the Texas Commission on Fire Protection so as to keep Dallas Fire-Rescue personnel certifications active and the department in compliance with all TCFP rules. The TCFP requires a minimum of 20 hours continuing education for structural firefighters along with an additional 10 hours for hazardous materials technicians (TCFP, n.d.b). Dallas Fire-Rescue requires all emergency operations hazardous materials technicians to complete a minimum of 20 hours continuing education pertaining to hazardous materials and a minimum of 20 hours in structural firefighting. (DFR, 2008a, p. 9). It has been a ritual for DFR hazardous materials technicians to exceed the mandated ten (10) hours of continuing education because of the included emphasis on weapons of mass destruction (WMD). Most of the continuing education training hours are accomplished during regular on-duty work hours.

E. CORE KNOWLEDGE, SKILLS, AND ABILITIES

The core knowledge, skills, and abilities (KSA), for hazardous materials technicians are listed in Table 1 and obtained directly from *NFPA 472 Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* (NFPA, 2008b) and *Section 604 of Certification Curriculum Manual, Chapter Six Hazardous Materials NFPA 472, 2008 Edition, Texas Commission on Fire Protection* (TCFP, 2010a). Core KSA define the capabilities of a Hazardous Materials Technician and what is required for the individual to effectively function in the role of a hazardous material technician to successfully accomplish missions they are tasked with. See Table 1 *NFPA 472 Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* (After NFPA, 2008b) and *Section 604 of Certification Curriculum Manual, Chapter Six Hazardous Materials NFPA 472, 2008 Edition*.

Table 1. Core Knowledge, Skills, and Abilities for Hazardous Material Technicians (After TCFP, 2010a)

Core Knowledge, Skills, and Abilities for Hazardous Materials Technicians
General knowledge of laws, regulations, and national standards
Ability to analyze the hazardous materials/WMD (Weapons of Mass Destruction) incident to determine complexity of problems and potential outcomes
Skills to survey the hazardous materials/WMD incident to indentify special containers, storage tanks, railroad cars, non-bulk packaging, and radioactive packaging; indentify or classify unknown hazardous materials; verify the presence and concentrations of hazardous materials through the use of instrumentation, detection and monitoring equipment
Skills to collect and interpret hazard and response information from printed and technical resources, computer databases, and monitoring equipment
Ability to describe the condition of the container involved in the incident and assess the level of risk associated with the damage
Ability to predict the likely behavior of released materials and their containers with multiple materials involved
Ability to estimate the likely size of an endangered area
Ability to plan a response within the capabilities of available personnel, defining objectives, potential options, and selecting proper personnel protective equipment
Ability to select a technical decontamination process to minimize the hazard
Ability to develop a plan of action for hazardous materials/WMD incident
Skills to implement the planned response to favorably change the outcome
Skills to perform the incident command duties within the local incident management system
Skills to don and effectively function in protective clothing and respiratory protection

Core Knowledge, Skills, and Abilities for Hazardous Materials Technicians
Skills to perform control functions identified in the Incident Action Plan (IAP)
Skills to perform decontamination functions identified in the Incident Action Plan (IAP)
Ability to evaluate the progress of the hazardous materials incident/WMD concerning the effectiveness of the control functions and decontamination process
Knowledge to terminate the hazardous materials/WMD incident
Knowledge to assist in the incident debriefing and incident critique
Skills to provide reports and documentation of the hazardous materials/WMD incident

F. COST OF TRAINING

The cost of training hazardous materials technicians can vary depending on where the class is held (locally versus out-of-town requiring a hotel stay and per diem allowances) and the number of people that need to be trained. Along with the cost of all the required training for the class comes the associated cost of the backfill for the member that is attending hazardous materials technician training. Backfill is the replacement staffing cost for the vacant position the member attending school creates. Backfill is calculated at an estimated overtime rate because the member usually staffing the vacant position is assigned to another shift and will exceed their normal hours worked during a pay period thus drawing overtime pay.

In order to determine an accurate estimated cost for training hazardous materials technicians, a few substantial factors bear consideration, such as locating and selecting an accredited TCFP hazardous materials technician class with reasonable tuition rates and determine the number of individuals allowed to attend training at one time due to DFR daily mandatory staffing level requirements. At the time of this writing, the most cost

effective TCFP accredited class offered is local in proximity to the city of Dallas at a cost of $580.00 per person (Tarrant County College Fire Service Training Center, n.d.b).

According to an e-mail from the DFR Financial Services Assistant Director, the actual hourly overtime rate for all ranks (fire and rescue officer, driver engineer, lieutenant, captain, or battalion chief) is $37.00. However, the average backfill hourly rate includes figuring 27.5 percent for pension benefits [$37.00 x 27.5% = 10.175 + 37.00 = 47.175], which makes the current accurate backfill estimate $47.00 per hour.

DFR members attending hazardous materials technician training are normally assigned to 24-hour shifts. It will be necessary to adjust the DFR members' work schedule while they attend the 80-hour HMT training course. The member attending HMT training will be placed on training leave and relieved of their station work assignment for the duration of the class. Members assigned to a 24 hour shift will receive 12-hours credit for each day spent in class. (DFR, 2008, pp. 401–403). For the 80-hour HMT class, scheduled for 10 days at eight hours per day, each member will be placed on training leave for a total of five 24-hour shifts. This creates a vacant position at each station for five 24-hour shifts that DFR members are on training leave and must be replaced with qualified DFR personnel (backfill) due to mandatory minimum staffing levels.

The city of Dallas follows the standard mileage rates established by the Internal Revenue Service (IRS). The current IRS standard mileage rate of 51 cents per mile will be used for estimating mileage reimbursement cost (Internal Revenue Service [IRS], 2010). Actual mileage for DFR members attending training locally will be calculated from each member's normal work assignment to the location the class is being conducted. The mileage estimate used for Table 2 is calculated from the DFR Training Academy to the location of the scheduled HMT class.

The Texas Commission on Fire Protection charges a standard fee of $35.00 for each application for certification once the hazardous materials technician has successfully passed the commission exam (TCFP, n.d.b). After the $35.00 fee is received and

processed, the TCFP will send the HMTs certificate of certification to Dallas Fire-Rescue and update the commission's database to reflect each individual that possesses a Hazardous Materials Technician Certificate (TCFP, n.d.b).

Another significant cost that must to be figured into the overall cost of training personnel, is an initial medical physical. *Code of Federal Regulations 29 CFR 1910.120 (f) Medical Surveillance* directs employers to establish a medical surveillance program requiring members of Hazardous Materials Response Teams to undergo a medical physical every 12 months (United States Department of Labor, 2011). Dallas Fire-Rescue provides a medical surveillance program for all Hazardous Materials Response Team members in accordance with regulation the listed above (DFR, 2008a, p. 17). Before a hazardous materials technician can be assigned to the HMRT, a medical physical must be completed and a physician must deem the individual medically fit for participation in the HMRT (DFR, 2008a, pp. 17–18). All HMRT members will complete a medical physical every 12 months, as stated above (DFR, 2008a, p. 17).

At the time of this research, DFR does not have a Hazardous Materials Response Team medical surveillance vendor contract for 2011, but a request proposal for medical surveillance has been submitted to the DFR Financial Services Assistant Director. The city purchasing agent has not completed the bid process for medical physicals. According to past medical surveillance records protected under the Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy and Security Rules and kept by the hazardous materials coordinator, the current proposal for medical physicals could be estimated at a cost of approximately $1,900.00 per individual physical. This is the figure that will be used to factor in the total cost of training a DFR hazardous materials technician, refer to Table 2.

Table 2. Cost for Training a Hazardous Materials Technician

	Cost of Hazardous Materials Technician Class	Length of Class	Backfill Cost	Mileage Cost	TCFP Test Certification Fee	Initial Hazardous Materials Technician Medical Physical
Per Person	$580.00	80 hours	$5,640.00	$435.50	$35.00	$1,900.00
					Total Cost Per Person	**$8,590.50**

According to the research displayed in Table 2, the accurate estimated total cost to train one Dallas Fire-Rescue member to the level of a hazardous materials technician is $8,590.50.

G. EVALUATION OF HAZARDOUS MATERIALS RESPONSE TEAM (HMRT) HOMELAND SECURITY ROLE

The Global War on Terrorism (GWOT) has focused much attention on dangerous weapons of mass destruction (WMD). WMD can be developed using chemical, biological, radiological, and nuclear (CBRN) agents. While CBRN incidents can be classified as hazardous materials incidents, the amount, combination, method used to disperse these agents, locations of the release, and number of human fatalities, as well as the overall impact to the community, will dictate the level to which an incident is classified. The level of classification could range from a local emergency incident to a mass casualty incident (MCI) requiring extensive resources and could further be complicated by decontamination requirements.

One of America's toughest challenges stated in the *National Strategy for Homeland Security* is "WMD in the hands of terrorists is one of the gravest threats we face, and we cannot permit the world's most dangerous terrorists to threaten us with the world's most destructive weapons" (DHS, 2007b, p. 15). Hazardous Materials Response Teams have an integral role to play on the frontlines by responding to and interdicting threats of chemical, biological, radiological, and nuclear agents when our layers of defense have been infiltrated. Trained Hazardous Materials Response Technicians are a

critical component in determining the level of classification a hazardous materials event will be by using specialized equipment (i.e., instrumentation, monitors, detectors, and other sampling collection devices) to make on-scene risk evaluations.

Hazardous Materials Response Teams are in line with *Homeland Security Presidential Directive-5* in that they enhance the capabilities across the nation by using a "national approach to domestic incident management" (DHS, 2003a). Once a Hazardous Material Response Team has assessed the risk evaluation of an event, they can determine if the incident can be mitigated with the resources available or if conditions are such that require a substantially larger amount of resources.

In accordance with *Homeland Security Presidential Directive-5, Policy number eight (8)*, that states (2003a):

> Following a terrorist threat or an actual incident that falls within the criminal jurisdiction of the United States, the full capabilities of the United States shall be dedicated, consistent with United States law and with activities of other Federal departments and agencies to protect our national security, to assisting the Attorney General to identify the perpetrators and bring them to justice. (Department of Homeland Security. (DHS, 2003a)

It will most likely be Hazardous Materials Response Teams with their specialized training and equipment assisting federal departments, other law enforcement agencies, and the Attorney General in seeking justice by being the primary evidence collectors of hazardous substances from terrorist threats or any actual event that will determine if the cause was terrorism.

Strengthening national preparedness is the subject of *Homeland Security Presidential Directive-8* (HSPD-8) (DHS, 2008a), which is precisely the function Hazardous Materials Response Teams provide by improving our ability to shape operational actions through the National Incident Management System (NIMS) concept of coordination and strategic preparedness goals (DHS, 2008b). HMRT is a special operations resource of the fire service at the local level that can support and strengthen national preparedness goals outlined in HSPD-8.

Hazardous Materials Response Teams are part of the comprehensive strategy for countering WMD and represents one of the appropriate civilian agencies described in *Homeland Security Presidential Directive-4 (HSPD-4) [unclassified version]*, *National Strategy to Combat Weapons of Mass Destruction*, that are prepared to respond and defend the homeland from complex threats of CBRN events (Federation of American Scientists, 2002). As first responders, Hazardous Materials Response Teams are on the forefront working to alleviate further risk and impacts of catastrophic disasters within communities they serve, while participating in the complex challenges of homeland security and defense.

III. DALLAS FIRE-RESCUE (DFR) URBAN SEARCH AND RESCUE TEAM (US&R)

A. PURPOSE

The purpose of the DFR Urban Search and Rescue Team (US&R), is to respond and mitigate unique multi-hazard emergencies or events caused by terrorist attack, natural or man-made disasters (DFR, 2008b). These events may involve no fire threat, the potential to ignite, or those that are on fire (Norman, 2009). US&R Team members are capable of supporting emergencies in progress or events such as weather-related incidents that may gradually develop with advanced technical rescue skills, thus exceeding the basic fire responder's qualifications and ability to safety respond in a complex rescue environment (DFR, 2008b).

B. ORGANIZATION OF DFR URBAN SEARCH AND RESCUE TEAM

The US&R Team serves a dual function role in Dallas Fire-Rescue; members are full-time structural firefighters and a full-time urban search and rescue team. The US&R Team members are certified structural firefighters and trained in various levels of urban search and rescue. All members must hold a certification as a structural firefighter with the Texas Commission on Fire Protection (TCFP). TCFP is the regulatory authority that enforces statewide fire service standards and provides education and assistance to the fire service as defined by Chapter 419 of the Texas Government Code (TCFP, 2010b).

DFR has two fire stations (15 and 19) that are designated as US&R stations (DFR, 2008b). Each station must have a daily minimum staffing of 10 US&R trained members and one of the 10 must be an officer (DFR, 2008b, p. 13). Members assigned to station 15 or 19 will be trained and certified in five different disciplines within search and rescue training (2008b):

1. Rope rescue technician
2. Structural collapse technician
3. Technical search specialist

4. Confined space rescue

5. Trench rescue (DFR, 2008b)

Members are eligible for assignment to station 15 or 19, if they are certified in two of the five search and rescue disciplines, with the caveat being they must complete the remaining required disciplines within a year of assignment. At a minimum, members must be certified as a rope rescue technician and structural collapse technician, or technical search specialist, to meet the qualification of two search and rescue disciplines for permanent assignment to either station (DFR, 2008b, p. 8).

Minimum staffing requirements of 10 US&R members for stations 15 and 19 basically coincide with DFR minimum daily staffing levels department wide of four firefighters on every engine and truck (DFR, 2008, p. 266). Minimum staffing for DFR rescues (mobile intensive care units) is two paramedics. Stations 15 & 19 each house an engine, a truck, a rescue and a US&R apparatus for urban search and rescue response. The required minimum daily staffing levels department wide for fire apparatus satisfies the staffing levels for the dual function role of the US&R Team.

The foundation for DFR minimum staffing levels are safe operations and quality of job performance, which is based on two National Fire Protection Association (NFPA) standards:

Chapter 5, *Fire Department Services, NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* (NFPA, 2009b) states:

> 5.2.3 Operating Units. Fire company staffing requirements shall be based on minimum levels necessary for safe, effective, and efficient emergency operations.
>
> 5.2.3.1 Fire companies whose primary functions are to pump and deliver water and perform basic firefighting at fires, including search and rescue, shall be known as engine companies.
>
> 5.2.3.1.1 These companies shall be staffed with a minimum of four on-duty personnel.

> 5.2.3.2 Fire companies whose primary functions are to perform the variety of services associated with truck work, such as forcible entry, ventilation, search and rescue, aerial operations for water delivery and rescue, utility control, illumination, overhaul, and salvage work, shall be known as ladder or truck companies.
>
> 5.2.3.2.1 These companies shall be staffed with a minimum of four on-duty personnel. (NFPA, 2009b, p. 9)

Chapter 8, *Emergency Operations, NFPA 1500 Standard on Fire Department Occupational Safety and Health Program* (NFPA, 2006) states:

> 8.5.7 In the initial stages of an incident where only one crew is operating in the hazardous area at a working structural fire, a minimum of four individuals shall be required, consisting of two individuals working as a crew in the hazardous area and two individuals present outside this hazardous area available for assistance or rescue at emergency operations where entry into the danger area is required.
>
> 8.5.8 The standby members shall be responsible for maintaining a constant awareness of the number and identity of members operating in the hazardous area, their location and function, and time of entry.
>
> 8.5.9 The standby members shall remain in radio, visual, voice, or signal line communication with the crew.
>
> 8.5.16 Once a second crew is assigned or operating in the hazardous area, the incident shall no longer be considered in the "initial stage," and at least one rapid intervention crew shall be deployed that complies with the requirements of 8.8.2.
>
> 8.8.2 A rapid intervention crew/company (RIC) shall consist of at least two members and shall be available for rescue of a member or a crew. (NFPA, 2006, pp. 24–25)

The NFPA standards above refer to basic structural firefighting. These standards have been adopted because "staffing requirements shall be based on minimum levels necessary for safe, effective, and efficient emergency operations" (NFPA, 2009, p. 9). While there is no minimum staffing standard for a full-time US&R Team and given the complex nature of technical rescue events, Dallas Fire Rescue follows the NFPA basic

structural firefighting standards as a minimum guideline for technical rescue. Since minimum staffing levels for structural firefighting has been determined by the NFPA, it is a prudent practice to at least maintain these staffing levels for performing more complex special rescue incidents. Technical rescue events involve complicated intricate techniques that are beyond the scope of standard operating procedures (SOP). Adequate levels of trained personnel are required to perform a successful technical rescue because the operational environment may or may not involve fire and there is a high potential for critical injury or death to the victim or the unprepared rescue team (Norman, 2009, p. 6). Due to the high risk involved, it is necessary to maintain a rapid intervention crew (RIC) and a medical surveillance component (paramedics) during the rescue procedure in case a rescuer becomes a victim.

The Dallas Fire-Rescue US&R Team is not part of the Federal Emergency Management Agency (FEMA) national urban search and rescue response system. However, DFR does adhere to the FEMA National Incident Management System (NIMS) recommendations for search and rescue resource typing (DFR, n.d). Resource typing supports the NIMS initiative by classifying search and rescue resources according to capabilities, personnel, equipment, and training. Classifying federal, state, and local response assets prior to a disaster response defines the capability of the resource and allows the requesting agency to determine and select what or if a response asset meets the response need for a catastrophic event (FEMA, 2007, p. 2). According to the FEMA *Typed Resource Definitions Search and Rescue Resources* manual, the DFR US&R Team is a Type III Urban Search and Rescue Task Force (FEMA, 2007, p. 9).

C. CAPABILITIES

DFR US&R Team has capabilities for emergency technical rescue response (i.e., rope rescue, structural collapse, confined space, and trench rescue) within the city of Dallas, mutual aid to any city contiguous to Dallas, and a regional response to 16 designated north Texas counties (DFR, 2008b, p. 1). These emergency responses are defined as: Tier 1 response—inside the city limits of Dallas and mutual aid to contiguous cities; Tier 2 response—is a regional response to the 16-county region (i.e., Collin,

Dallas, Denton, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwall, Somervell, Tarrant, and Wise counties) as defined by the North Central Texas Council of Governments (NCTCOG) (DFR, 2008b, pp. 5–6).

When responding to a Tier 1 incident, US&R 15 and 19 will immediately respond with a total of 20 urban search and rescue members (DFR, 2008b). Other support units and resources will be dispatched to the incident (i.e., four hazardous materials technicians, two logistics command technicians, and two battalion chiefs to serve as a task force leader and a safety officer for a full complement of 28 personnel for a Type III US&R Task Force) (2008b). Depending on the type of technical rescue, severity or complexity of the event, other resources can be special called to the incident if needed, such as structural engineers, physicians, heavy equipment, search and rescue canines, etc. (2008b).

In the event of a Tier 2 regional response, US&R 15 and 19 (20 urban search and rescue members), Hazardous Materials Response Unit with four hazardous materials technicians, three logistics command technicians, and battalion chiefs to fill the task force leader or safety officer positions will respond to the DFR Training Academy to assemble a convoy and proceed to the technical rescue incident together (DFR, 2008b, p.6). An advance team comprised of a battalion chief and logistics command technician can be selected to proceed to the location of the disaster, perform a reconnaissance, make contact with the jurisdiction having authority, and provide the responding convoy with accurate updated information (2008b). Other special call resources can be determined and requested as necessary.

D. STANDARDS FOR CURRICULUMS

The standards for urban search and rescue core curriculums in the disciplines of rope rescue technician, structural collapse technician, confined space rescue, and trench rescue adhere to specific National Fire Protection Association (NFPA) standards. There are no specific National Fire Protection Association standards for a technical search specialist other than the general requirements stated in *Chapter 4 Technical Rescuer, National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer*

Professional Qualifications 2008 Edition, where the authority having jurisdiction (AHJ) will establish the training and rescue operations requirements to satisfy the needs of the jurisdiction (NFPA, 2008a, p. 13).

According to Texas Engineering Extension Service (TEEX), a member of the Texas A & M University System and leader in educating and training emergency responders (Texas Engineering Extension Service [TEEX], n.d.a) only FEMA National US&R task force members can attend FEMA-sanctioned training courses. TEEX developed a Disaster Technical Search Specialist course that mirrors the FEMA US&R curriculum because of the high demand from jurisdictions requesting disaster technical search specialist training at the same level as FEMA task force members (TEEX, 2009b, p. 3). The TEEX disaster technical search specialist training draws from the guidelines of the *National Preparedness Vision, National Planning Scenarios, Target Capabilities List (September 2007)* and *Universal Task List (Version 2.1 issued May 23, 2005)* (TEEX, 2009b, pp. 4–5).

The National Board on Fire Service Professional Qualifications (NBFSPQ), commonly referred to as the Pro Board, is a non-profit third-party organization that accredits agencies using the National Fire Protection Association professional qualifications standards (Pro Board, 2010). The mission of the Pro Board is to establish an internationally recognized standard for career and volunteer fire departments (2010). Agencies accredited by Pro Board can offer individuals certification in the Pro Board national registry upon verification of successfully passing a competency exam (2010). An advantage of a Pro Board certificate and inclusion in the national registry for individuals is reciprocity among departments that recognize the Pro Board certifications (2010). An individual's cost can range from $5.50 to $15.00 to join the national registry and obtain a Pro Board certificate (2010).

Dallas Fire-Rescue requires that each member of the US&R Team participate in a minimum of 40 hours continuing education (CE) encompassing the five search and rescue disciplines (DFR, 2008b, p. 9). These 40 CE hours are in addition to the 20 CE hours required by the Texas Commission on Fire Protection (TCFP) for structural firefighters. There is no requirement by the TCFP, the state regulatory authority, for

continuing education training hours in search and rescue. However, it is the responsibility of the sponsoring agency (DFR) to maintain proficiency in search and rescue operations and equipment to the level of training and certification that has been achieved. Most continuing education hours are accomplished during regular on-duty work hours.

E. CORE KNOWLEDGE, SKILLS, AND ABILITIES

1. Rope Rescue Technician

The core knowledge, skills, and abilities (KSA) for rope rescue technician are listed in Table 3 and obtained directly from *Chapter 5 Job Performance Requirements* and *Chapter 6 Rope Rescue* of the *National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer Professional Qualifications 2008 Edition* (NFPA, 2008a). Core KSA define the capabilities and qualifications for the individual to function effectively in the role of rope rescue technician and successfully accomplish missions they are tasked with. It is further recommended that rope rescue technicians have a general knowledge of Chapters IV and V from *NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents 2009 Edition,* which is the standard for organizations providing response to technical search and rescue incidents (NFPA, 2009a). See Table 3 from *Chapter 5 Job Performance Requirements* and *Chapter 6 Rope Rescue* of the *National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer Professional Qualifications 2008 Edition.*

Table 3. Core Knowledge, Skills, and Abilities for Rope Rescue Technicians (After NFPA, 2008a)

Core Knowledge, Skills, and Abilities for Rope Rescue Technicians
Knowledge of site operations regarding support resources, managing available resource cache, scene lighting, environmental concerns, and managing personnel by ensuring rehabilitations needs

Core Knowledge, Skills, and Abilities for Rope Rescue Technicians
Ability to analyze the incident: gather information, determine type of rescue needed, and develop an incident action plan
Ability to manage incident hazards so risks to victims and rescuers are minimized while remaining cognizant of rescue time constraints
Skills to implement an incident management system, match resources to operational needs, and manage incident communications
Knowledge of local policies and procedures, how to operate in a site-specific search environment, and maintain personnel accountability
Skills to perform self-rescue techniques
Knowledge to perform ground support for helicopter activities: landing zones, aircraft safety systems, and communications protocols
Knowledge to terminate a technical rescue operation
Knowledge of victim management and local protocols to effectively triage and provide care
Skills to secure victim to specialized equipment and remove them from the hazard without further injury
Ability to transfer victim to emergency medical services
Knowledge to inspect and maintain personnel protective clothing and rescue equipment for operational readiness
Skills to tie knots, bends, and hitches for specific applications
Knowledge of rope/rigging terminology
Ability to select rope and rigging systems, evaluate and anchor properly, and place edge protection
Skills to construct and direct a team in a simple rope mechanical advantage system and operate properly in low-angle or high-angle operations
Skills to function as a litter attendant in a lowering system

Core Knowledge, Skills, and Abilities for Rope Rescue Technicians
Skills to construct and direct a lowering operation in a low-angle and high-angle environment
Skills to construct and safely operate a belay system
Ability to perform a complete safety system check for personnel safety
Skills to construct a multiple-point anchor system and ensure integrity of the system is maintained throughout the operation
Knowledge of angles to forces created in multiple-point anchor systems and formulas needed to calculate safety factors for loads
Skills to construct a compound rope mechanical advantage system and a fixed rope system safely and effectively
Ability to direct the operation of a compound rope mechanical advantage system in a high-angle environment using proper operating methods
Skills to ascend and descend a fixed rope in a high-angle environment in a controlled safe manner
Skills to complete an assignment while suspended in a high-angle environment using proper techniques
Skills to move a victim in a high-angle environment while minimizing risk to the rescuer and victim
Skills to function as a litter attendant in a high-angle environment
Ability to direct a team in the safe removal of a victim suspended from a rope in a high-angle environment

2. Structural Collapse Technician

The core knowledge, skills, and abilities (KSA) for Structural Collapse Technician are listed in Table 4 and obtained directly from *Chapter 9 Structural Collapse, National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer Professional Qualifications 2008 Edition* (NFPA, 2008a). Core KSA define the

capabilities and qualifications for the individual to function effectively in the role of Structural Collapse Technician and successfully accomplish missions they are tasked with. It is further recommended that Structural Collapse Technicians have a general knowledge of Chapters IV and VI from *NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents 2009 Edition,* which is the standard for organizations providing response to technical search and rescue incidents (NFPA, 2009a). See Table 4, pulled from *Chapter 9 Structural Collapse, National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer Professional Qualifications 2008 Edition*.

Table 4. Knowledge, Skills and Abilities for Structural Collapse Technician (After NFPA, 2008a)

Knowledge, Skills, and Abilities for Structural Collapse Technician
Knowledge of light frame construction types and hazards and effects associated with structural collapse
Ability to determine potential victim locations in light frame construction collapse incident and establish search areas
Ability to develop a collapse rescue incident action plan for light frame collapse
Skills to implement a collapse rescue incident action plan for a light frame collapse structure
Ability to implement an incident management system as applied to the search function of locating victims in a light frame collapse structure
Skills to stabilize a collapse light frame structure
Knowledge of resources and support resources for lighting, environmental control, and rescuer rehabilitation protocols
Skills to release/remove a victim from entrapment of a light frame collapse structure
Skills to lift/move a heavy lead as a team member

Knowledge, Skills, and Abilities for Structural Collapse Technician
Skills to breach light frame structural components
Skills to construct cribbing systems in a light frame collapsed structure
Knowledge of heavy construction type structure and hazards and effects associated with structural collapse
Ability to determine potential victim locations in a heavy construction type incident and establish search areas
Ability to develop a collapse rescue incident action plan for a heavy collapsed structure
Skills to implement a collapse rescue incident action plan for a heavy construction type collapsed structure
Ability to implement an incident management system as applied to the search function of locating victims in a heavy construction type collapsed structure
Skills to stabilize a collapsed heavy construction type structure
Knowledge of resources and support resources for lighting, environmental control, and rescuer rehabilitation protocols
Skills to release/remove a victim from entrapment of a heavy construction type collapse incident
Skills to lift/move a heavy load as a team member
Skills to breach heavy structural components
Skills to construct cribbing systems in heavy construction type collapse
Skills to cut through structural steel
Ability to coordinate the use of heavy equipment utilizing safety protocols and establishing communications

3. Technical Search Specialist

The technical search specialist curriculum is based on utilizing technology (i.e., listening devices, search cameras, and Global Positioning System (GPS) tracking and navigation units) while performing technical searches (TEEX, 2009a). The core knowledge, skills, and abilities (KSA) for technical search specialist are listed in Table 5 and obtained directly from the TEEX *Disaster Technical Search Specialist TNG-11S Program of Instruction* that references specific capabilities of *Target Capabilities List (September 2007)* and critical task of *Universal Task List (Version 2.1 issued May 23, 2005)* (TEEX, 2009b, pp. 6–9). Core KSA define the capabilities and qualifications for the individual to function effectively in the role of technical search specialist and successfully accomplish missions they are tasked with. See Table 5 from *Disaster Technical Search Specialist TNG-11S Program of Instruction*.

Table 5. Knowledge, Skills, and Abilities for Technical Search Specialist (After TEEX, 2009b)

Knowledge, Skills, and Abilities for Technical Search Specialist
Knowledge of the Search and Rescue (SAR) planning process and operational briefings
Ability to plan and coordinate Search and Rescue operations at the incident site
Ability to direct Search and Rescue (SAR) resources according to the National Incident Management System (NIMS), the Incident Command System (ICS), and consensus-level technical rescue standards
Skills to provide timely situational awareness and response information
Ability to establish and maintain a chronological log of events in the field
Skills to document and collect Search and Rescue operations information, including chronological log of event in the field for use in after action review
Ability to access incident site to determine Search and Rescue course of action

Knowledge, Skills, and Abilities for Technical Search Specialist
Ability to assess the incident site for hazardous materials and other environmental conditions
Skills to develop map of search area to be used in Search and Rescue tactical operations
Skills to communicate findings and recommend priorities to Team Management
Ability to ensure scene/site safety (security, shoring, debris)
Skills to conduct area search for victims
Skills to search for victims using canine, physical, and electronic search capabilities
Ability to identify and record potential/actual victim locations (live and dead)
Skills to direct ambulatory victims to safe assembly point
Skills to report progress of search efforts on a regular basis to Search and Rescue lead
Ability to maintain accountability for search personnel, equipment, and supplies
Skills to conduct Search and Rescue while continuing to assess situational needs
Skills to conduct urban search and rescue operations
Ability to direct search and rescue teams and collapse-site teams
Skills to search and extract victims from site
Skills to provide status reports on urban search and rescue operations
Ability to provide care for rescuers, including the canine (K-9) first responders

4. Confined Space Rescue

The core knowledge, skills, and abilities (KSA), for confined space rescue are listed in Table 6, and obtained directly from Chapter VII *Confined Space Rescue*, *National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer*

Professional Qualifications 2008 Edition (NFPA, 2008a). Core KSA define the capabilities and qualifications for the individual to function effectively in the role of confined space rescue and successfully accomplish missions they are tasked with. It is further recommended that confined space rescuers have a general knowledge of Chapters IV and VII from *NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents 2009 Edition*, which is the standard for organizations providing response to technical search and rescue incidents (NFPA, 2009a). See Table 6 taken from Chapter VII *Confined Space Rescue, National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer Professional Qualifications 2008 Edition*.

Table 6. Knowledge, Skills, and Abilities for Confines Space Rescue (After NFPA, 2008a)

Knowledge, Skills, and Abilities for Confined Space Rescue
Knowledge of capabilities and limitations of detection and monitoring equipment and effects of ventilation in determining atmospheric conditions in a confined space
Ability to operate monitoring equipment and perform rescuer pre-entry evaluations
Skills to enter a confined space make contact with the victim and initiate patient care
Skills to package a victim for removal from a confined space
Skills to remove all entrants from a confined space, decontaminate as necessary, and deliver victims to emergency medical service providers
Ability to preplan a confined space incident using supplied forms
Skills to implement the confined space incident preplan
Ability to control hazards—access to the incident scene is controlled and mitigate physical and atmospheric hazards

5. Trench Rescue

The core knowledge, skills, and abilities (KSA) for Trench Rescue are listed in Table 7, and obtained directly from *Chapter 8 Trench Rescue, National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer Professional Qualifications 2008 Edition* (NFPA, 2008a). Core KSA define the capabilities and qualifications for the individual to function effectively in the role of trench rescuer and successfully accomplish missions they are tasked with. It is further recommended that trench rescuers have a general knowledge of Chapters IV and XI from *NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents 2009 Edition*, which is the standard for organizations providing response to technical search and rescue incidents (NFPA, 2009a). See Table 7, culled from *Chapter 8 Trench Rescue, National Fire Protection Association (NFPA) 1006 Standard for Technical Rescuer Professional Qualifications 2008 Edition*.

Table 7. Knowledge, Skills, and Abilities for Trench Rescue (After NFPA, 2008a)

Knowledge, Skills, and Abilities for Trench Rescue
Knowledge of methods to distinguish soil types, collapse mechanics, and other contributing environmental factors affecting trench rescue efforts
Skills to implement a trench emergency action plan
Skills to implement support resource operations at a trench emergency regarding lighting, dewatering techniques, atmospheric monitoring, and rescuer rehabilitation
Ability to interpret tabulated data information and tables for placing shoring and shielding systems
Skills to release/remove victim from a trench entrapment, package victim, initiate patient care while cognizant of extrication time
Skills to disassemble support systems at a trench emergency incident, complete reports, and perform post debriefing

Knowledge, Skills, and Abilities for Trench Rescue
Skills to support an intersecting trench as a member of a team with a rapid intervention team staged
Skills to install supplemental sheeting and shoring below an existing approved shoring system with a rapid intervention team staged
Ability to construct different types of load stabilization systems
Skills to lift a load with the correct tools to meet the operational objectives
Ability to coordinate the use of heavy equipment utilizing safety protocols and establishing a method of communication
Skills to release a victim from entrapment of a collapsed trench without compromising the integrity of the existing trench shoring system

F. COST OF TRAINING

The cost of training urban search and rescue personnel can vary depending on where the class is held (locally versus out of town requiring a hotel stay and per diem allowances) and the number of people that need to be trained. Along with the cost of all the required training for the class comes the associated cost of the backfill for the member that is attending urban search and rescue training. Backfill is the replacement staffing cost for the vacant position the member attending school creates. Backfill is calculated at an estimated overtime rate because the member usually staffing the vacant position is assigned to another shift and will exceed their normal hours worked during a pay period thus drawing overtime pay.

DFR members attending urban search and rescue training are normally assigned to 24 hour shifts. In most cases, it will be necessary to temporarily adjust the DFR members' work schedule while they attend classes that are scheduled daily for the duration of the training course to complete the total number of hours required for the class. When necessary, DFR places the member attending urban search and rescue courses on training leave in accordance with the procedures for *Training Operations Personnel* as stated in *Dallas Fire-Rescue Manual of Procedures Volume 5 General*

Procedures 2008 (DFR, 2008). This allows members assigned to 24 hour shifts to receive 12-hours credit for each day spent in class (DFR, 2008, pp. 401–403). This temporary work adjustment also determines the number of hours that must be paid in backfill because of the vacant position incurred at the fire station. For example, an 80-hour class, scheduled for 10 days at eight hours per day, requires that each member be placed on training leave for a total of five 24-hour shifts. This creates a vacant position at a fire station for five 24-hour shifts that backfill must be paid due to complying with DFR mandatory minimum staffing levels.

In order to figure an accurate estimated cost for training urban search and rescue members in the five disciplines, DFR requires that a few substantial factors bear consideration, such as locating and selecting an accredited class with reasonable tuition rates and determining the number of individuals allowed to attend training at one time due to DFR daily mandatory staffing level requirements. All of these factors will be taken into consideration in calculating the cost estimates in this research for the purpose of providing complete accuracy in determining the total cost of training urban search and rescue members in all five disciplines.

Some standard rates that will be used to calculate cost for each urban search and rescue class is the backfill rate, mileage, lodging, and per diem rates. According to an e-mail from the DFR Financial Services Assistant Director, the actual hourly overtime rate for all ranks (fire and rescue officer, driver engineer, lieutenant, captain, or battalion chief) is $37.00. However, the average backfill hourly rate includes figuring 27.5 percent for pension benefits [$37.00 x 27.5% = 10.175 + 37.00 = 47.175] which makes the current accurate backfill estimate $47.00 per hour. The city of Dallas follows the standard mileage rates established by the Internal Revenue Service (IRS). The current IRS standard mileage rate of 51 cents per mile will be used for estimating mileage reimbursement cost (IRS, 2010). According to the City of Dallas Administrative Directive 4-7, maximum federal lodging, meal and incidental expense per diem rates will be paid in conformity with the rates identified by the Internal Revenue Service (IRS)

Publication 1542 (City of Dallas, 2004b). The city uses the U.S. General Services Administration (GSA) website to locate the maximum rates allowed for the destination of the traveler (City of Dallas, 2004b).

The Rope Rescue Technician level course found locally is 80 hours in length for two weeks at 10 hours per day with 96 hours to backfill at the station. The mileage estimate used for Table 8 will be calculated from the DFR Training Academy to the location of the scheduled Rope Rescue Technician course (Tarrant County College Fire Service Training Center, n.d.a).

Table 8. Cost for Training a Rope Rescue Technician

	Cost of Rope Technician Course	Length of Class	Backfill Cost	Mileage Cost
Per Person	$ 700.00	80 hours	$4,512.00	$348.40
			Total Cost Per Person	**$5,560.40**

The Structural Collapse Technician course is located out-of-town, 80 hours in length for eight consecutive days at 10 hours per day with 96 hours of backfill at the station. The mileage estimate used for Table 9 will be calculated from the DFR Training Academy to the location of the scheduled Structural Collapse Technician course (TEEX, n.d.b).

Table 9. Cost for Training a Structural Collapse Technician

	Cost of Structural Collapse Technician Course	Length of Class	Backfill Cost	Mileage Cost	Hotel Cost	Per Diem
Per Person	$2,600.00	80 hours	$4,512.00	$228.78	$744.00	$476.00
					Total Cost Per Person	**$8,560.78**

The Technical Search Specialist course is located out-of-town, 40 hours in length for five days at eight hours per day with 60 hours of backfill at the station. The mileage estimate for Table 10 will be calculated from the DFR Training Academy to the location of the scheduled Technical Search Specialist course (TEEX, n.d.c).

Table 10. Cost for Training a Technical Search Specialist

	Cost of Technical Search Specialist Course	Length of Class	Backfill Cost	Mileage Cost	Hotel Cost	Per Diem
Per Person	$1,500.00	40 hours	$2,820.00	$213.70	$465.00	$308.00
					Total Cost Per Person	**$5,306.70**

The Confined Space Rescue course found locally is 40 hours in length for four consecutive days at 10 hours per day with 48 hours to backfill at the station. The mileage

estimate used for Table 11 will be calculated from the DFR Training Academy to the location of the scheduled Confined Space Rescue course (Tarrant County College Fire Service Training Center, n.d.a).

Table 11. Cost for Confined Space Rescue Course

	Cost of Confined Space Rescue Course	Length of Class	Backfill Cost	Mileage Cost
Per Person	$350.00	40 hours	$2,256.00	$174.20
			Total Cost Per Person	**$2,780.20**

The Trench Rescue course found locally is 50 hours in length for one week at 10 hours per day with 60 hours to backfill at the station. The mileage estimate used for Table 12 will be calculated from the DFR Training Academy to the location of the scheduled Confined Space Rescue course (Tarrant County College Fire Service Training Center, n.d.a).

Table 12. Cost for Trench Rescue Course

	Cost of Trench Rescue Course	Length of Class	Backfill Cost	Mileage Cost
Per Person	$385.00	50 hours	$2,820.00	$217.75
			Total Cost Per Person	**$3,422.75**

The research for the individual cost of each urban search and rescue discipline is compiled in Table 13 to reflect the total cost of $25,630.83 for training one Dallas Fire-Rescue member in the five disciplines necessary for urban search and rescue. See Table 13.

Table 13. Total Cost of Entire Training for an Urban Search & Rescue Member

Dallas Fire-Rescue Urban Search and Rescue Five (5) Disciplines	**Total Cost for Training one (1) person per Discipline**
Rope Rescue Technician	$5,560.40
Structural Collapse Technician	$8,560.78
Technical Search Specialist	$5,306.70
Confined Space Rescue	$2,780.20
Trench Rescue	$3,422.75
Total Cost for Training one (1) Urban Search and Rescue member in all Five (5) US&R Disciplines	**$25,630.83**

G. EVALUATION OF URBAN SEARCH AND RESCUE TEAM HOMELAND SECURITY ROLE

As the nation continues to plan for preventing and interdicting terrorists' attacks to the best of our ability, the fact remains that we may not be successful all the time

despite our resiliency in preparedness methods. In the unfortunate case we are unsuccessful in preventing a terrorist attack, the *National Strategy for Homeland Security (2007)* states:

> Given the certainty of catastrophes on our soil—no matter how unprecedented or extraordinary—it is our collective duty to provide the best response possible. When needed, we will bring to bear the Nation's full capabilities and resources to save lives, mitigate suffering, and protect property. As the Nation responds based on the scope and nature of the incident, we must begin to lay the foundation not only for a strong recovery over the short term but also for the rebuilding and revitalization of affected communities and regions over the long term. This is crucial to reducing the psychological, social and economic effects of an incident. Ultimately response, recovery, and rebuilding efforts are tightly intertwined, each tapping into the resilience of the American spirit and our determination to endure and become stronger in the face of adversity. (DHS, 2007b, p. 31)

Fire service urban search and rescue teams will provide the best response possible to the community with their enhanced capabilities and flexibility for adjusting to extraordinary catastrophic events by being able to react to the potential threat of fire, those that are on fire, or those without the threat of fire (Norman, 2009, p. 4). As urban search and rescue teams respond and rescue victims, they will be laying the foundation for short and long-term recovery by rapidly developing an operational plan and moving through the time-sensitive phases of search and rescue. Once an area is cleared of victims, rescuers will collaborate with law enforcement to release the area for overhaul and clean-up.

Urban search and rescue teams become so close (physically and emotionally) to a catastrophic event, they develop a keen perspective and can understand and sense what the victims are feeling and enduring emotionally. Rescuers literally become a lifeline not only physically, but emotionally for the victims they are rescuing. During the process of working to extricate victims, rescuers wind up by default offering positive support and reinforcement to constantly calm the victims while monitoring their physical health. This in turn allows urban search and rescue teams an opportunity to assist victims emotionally by offering a foundation of support in prioritizing and bringing a sense of order to the

chaos happening around them. Urban search and rescue teams are not trained to administer psychological first aid (PSA), but they are familiar with the symptoms of distress due to traumatic events. Rescuers can immediately alert mental health professional to a victim or first responder in need of psychological first aid. While fire service urban search and rescue teams are intertwined in a reactive phase of the incident, they are assisting mental health professionals in a proactive phase of protecting the mental health of the community, thus lessening the impact of the disaster and moving the stricken community forward toward revitalization.

According to *Homeland Security Directive 8: National Preparedness,* the Secretary of Homeland Security was directed to "ensure the preparedness of the Nation to prevent, respond to, and recover from threatened and actual domestic terrorist attacks, major disasters and other emergencies" by developing "a national domestic all-hazards preparedness goal" (DHS, 2008a). The Secretary accomplished this mandate by releasing the *National Preparedness Guidelines* in September 2007. One purpose of the *National Preparedness Guidelines* is to "incorporate lessons learned from past disasters into national preparedness priorities" (DHS, 2007a, p. 1). There is no doubt that the lessons learned from the domestic terrorist attack on the Murrah Federal Building in Oklahoma City, Oklahoma, the 9/11 terrorist attacks, and Hurricane Katrina have solidified the preparedness priorities of urban search and rescue teams' response capabilities (DHS, 2007a, p. iii). Urban search and rescue teams are listed in the *National Preparedness Guidelines* as a capability for the response mission area with the conclusion being during time-sensitive disasters rescuers will rescue a large number of victims, render medical treatment, and maintain rescuer safety (2007a).

Urban search and rescue members are dedicated to the mission of rescue as stated in *The National Preparedness Guidelines* because they are comprised of members that have volunteered for search and rescue training in addition to their firefighting duties (DHS, 2007a). They have devoted numerous hours attending advanced technical courses and continuing education training to achieve a higher level of knowledge, skills, and abilities to ultimately provide the best response possible. Fire service urban search and

rescue members are dedicated because they want to be, and when people want to be part of the mission, there is no further justification needed because they will remain resolute and committed to success.

IV. DALLAS FIRE-RESCUE (DFR) EXPLOSIVE ORDNANCE DISPOSAL (EOD) TEAM

A. PURPOSE

The purpose of the DFR Explosive Ordnance Disposal (EOD) Team is to render safe and/or remove any type of suspected or confirmed improvised, incendiary or chemical explosive devices, pyrotechnics, and ammunition (Homeland Security and Operations Division, 2009, p. 1). Members of the EOD Team are responsible for investigating threats, incidents, or related incidents of accidental or intentional explosions, bombings, fire bombings, pyrotechnics, ammunition, as well as any device found that could be or potentially be a bomb (Homeland Security and Operations Division, 2009, pp. 4–5).

B. ORGANIZATION OF EXPLOSIVE ORDNANCE DISPOSAL TEAM

On April 22, 2009, the Federal Bureau of Investigation (FBI) granted approval for the Dallas Police Department (DPD) to relinquished control of the Explosive Ordnance Disposal (EOD) Team and transfer the responsibilities to Dallas Fire-Rescue according to a Dallas Fire-Rescue (DFR) *2009 Departmental Memorandum #34*, dated May 29, 2009. The DFR *2009 Departmental Memorandum #34*, further states, "The DPD members who are currently staffing the Bomb Squad will be assigned to Dallas Fire-Rescue until they promote, retire or are reassigned, however all future Bomb Technicians will come from DFD" [both Dallas Fire Department (DFD) and Dallas Fire-Rescue (DFR) are terms used interchangeably]. Staffing for Dallas Fire-Rescue Explosive Ordnance Disposal Team is four full-time Dallas Police Department bomb technicians that originally transferred to Dallas Fire-Rescue with the team.

An attachment included with *2009 Departmental Memorandum #34* depicts the Bomb Squad Transition Plan in three separate phases:

- Phase I, August 2008: August 2009, four Dallas Police bomb technicians will staff the EOD Team for eight hours per day and will be on call after hours

- Phase II, June 2009: December 2010, six Dallas Fire-Rescue bomb technicians complete training at the Hazardous Device School (HDS), will staff the EOD Team in eight hour shifts 24 hours per day
- Phase III, December 2010: December 2013, Dallas Fire-Rescue maintains eight to 12 bomb technicians through attrition, promotion, and training, will staff the EOD Team twenty-four (24) hours a day per *2009 Departmental Memorandum #34*.

The Bomb Squad Transition plan above will require all members in the future be trained as:

- Bomb technicians
- Hazardous materials technicians
- Police officers
- Arson investigators

As of February 2011, one section chief assigned to Dallas Fire-Rescue Arson Investigation Division has completed Hazardous Devices School (HDS).

The current staffing for the full-time EOD Team is comprised of one Dallas Police Sergeant who serves as the team supervisor and three Dallas Police investigator/bomb technicians (Homeland Security and Operations Division, 2009, p. 3). Their daily work hours are 0800 to 1700, and after hours they follow a monthly duty roster to ensure a proper response to all bomb calls (Homeland Security and Operations Division, 2009, p. 5). An EOD Team response requires a minimum staffing of two bomb technicians with essential safety equipment (Homeland Security and Operations Division, 2009).

It is noteworthy to acknowledge that approximately 10 percent of bomb squads reside in the fire service (Cox, 2004). Most bomb squads, including the first formal one assembled in the United States, the New York Police Department (NYPD) Bomb Squad, are under the direction of law enforcement (Cox, 2004).

C. CAPABILITIES

Presently the capabilities of the Explosive Ordnance Team is responding to threats, potential or actual incidents regarding all types of incendiary devices, explosives,

or bombings within the city of Dallas or the 16-county region (i.e., Collin, Dallas, Denton, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwall, Somervell, Tarrant, and Wise counties) as defined by the North Central Texas Council of Governments (NCTCOG) (Homeland Security and Operations Division, 2009, p. 14). Other capabilities include:

- Proper safe and legal transportation, storage, and disposal of explosives and hazardous devices
- Collecting and preserving evidence
- Submitting prosecution reports to the proper authority
- Conducting initial, follow-up, or joint investigations of all explosive/bomb related threats or events
- Providing dignitary protection when warranted (Homeland Security and Operations Division, 2009).

If the above Bomb Squad Transition Plan delineated in Dallas Fire-Rescue *2009 Departmental Memorandum #34* is actualized, the Explosive Ordnance Team will have the additional capabilities and responsibilities of investigating and determining all fire causes in the city of Dallas. These additional duties will entail automatic emergency responses to all multiple alarm fires or when a special request is made by an incident commander and when directed to do so by fire dispatch (DFR, 2003). The bomb technician/arson investigator will immediately respond to fires involving fatalities, serious burn victims, and when requested by the Dallas Police Department for criminal activity involving fire (DFR, 2003). The bomb technician/arson investigator trained police officer will have the authority to investigate, gather evidence, arrest suspects, and testify in court concerning incidents they have participated in (DFR, 2003).

D. STANDARDS FOR CURRICULUMS

Bomb Technicians, arson investigators, hazardous materials technicians, and police officers are independent noble career paths and are viewed that way by law enforcement and fire service professionals. However, Dallas Fire-Rescue is on a course of transforming one profession into a multi-dimensional career path with the current Bomb Squad Transition Plan.

This type of jack-of-all-trades, master of no particular discipline defies the approach and emphasis necessary in training individuals to advanced levels for special operations explosive ordnance disposal missions. Bomb incidents are low frequency events and the amount of time a bomb technician spends training is as important as the time police officers, arson investigators, and hazardous materials technicians spend benefiting from the experience acquired in responding to and participating in copious actual incidents. The passage below, taken from *Bomb Squad A Year Inside the Nation's Most Exclusive Police Unit* (Esposito & Gerstein, 2007), highlights the seriousness of every bomb technician truly being prepared to go down range and work on a device.

> The bomb technician, like other highly skilled mechanics—microsurgeons, test pilots, Formula One race car mechanics, or astronauts—is completely focused on his field. Practice is second nature. Reading technical journals is a steady activity. Reviewing each bomb that explodes anywhere in the world is the subject of daily squad discussion. Duplicating and disarming the most interesting devices goes without saying. Testing new tools; improving techniques; attending seminars on robot handling, disruption techniques, large vehicle bombs, booby traps, and the use of various kinds of detonators and explosives are the subjects of schedules posted on a chalkboard. The board also includes notices and sign-up lists for training with other units in the Police Department and with bombs squads in neighboring jurisdictions. Bomb technicians work in teams, and those teams have to be as smooth and efficient as a NASCAR pit crew. (Esposito & Gerstein, 2007, p. 58)

E. BOMB TECHNICIANS

The standards for Explosive Ordnance Disposal members (bomb technicians) curriculum is mandated by the U.S. Department of Justice Federal Bureau of Investigation (FBI) in law enforcement sensitive document *National Guidelines for Bomb Technicians*. The National Bomb Squad Commanders Advisory Board (NBSCAB), a standing committee of 12 elected bomb squad commanders from four national regions, serving three-year terms, has the final authority on explosive ordnance disposal teams guidelines and standards (National Bomb Squad Commanders Advisor Board [NBSCAB], n.d.a).

NBSCAB works collaboratively with the Hazardous Devices School (HDS), located at Redstone Arsenal in Huntsville, Alabama, (where bomb technicians are trained) to establish a national criteria for bomb technician certification as well as an accreditation process for bomb squads (NBSCAB, n.d.b). By reason of NBSCAB analysis and recommendations all bomb technician candidates must successfully complete the prerequisite of hazardous materials technician training prior to selection for admission to Hazardous Devices School (NBSCAB, n.d.b).

Dallas Fire-Rescue bomb technicians complete a minimum of 40 hours continuing education annually and a minimum of 16 hours practical exercise/training monthly in order to remain in compliance with the national guidelines (Homeland Security and Operations Division, 2009, p. 7). Most continuing education and practical exercise/training hours are accomplished during regular scheduled work hours.

F. HAZARDOUS MATERIALS TECHNICIAN

The Texas Commission on Fire Protection (TCFP) is the regulatory authority that enforces statewide fire service standards and provides education and assistance to the fire service as defined by Chapter 419 of the Texas Government Code (TCFP, 2010b). In the state of Texas, certification with the TCFP is mandatory for paid fire protection personnel to ensure the safety of fire personnel and compliance of fire departments with state laws and regulations (TCFP, 2007a).

The TCFP provides the certification curriculum for hazardous materials technicians in *Certification Curriculum Manual, Chapter Six Hazardous Materials NFPA 472, 2008 Edition, Texas Commission on Fire Protection* (TCFP, 2010a). The TCFP curriculum follows practically verbatim Chapter VII, Competencies for Hazardous Materials Technicians in the *National Fire Protection Association (NFPA) 472 Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents, 2008 Edition* (NFPA, 2008b). Clearly NFPA 472 is the crux for hazardous materials technician training and education.

Continuing education (CE) hours are required annually by the Texas Commission on Fire Protection so as to keep Dallas Fire-Rescue personnel certifications active and the department in compliance with all TCFP rules. The TCFP requires a minimum of 10 hours continuing education for hazardous materials technicians (TCFP, n.d.b). Most of the continuing education training hours are accomplished during regular on-duty work hours.

G. FIRE/ARSON INVESTIGATOR

The TCFP provides the certification curriculum for fire investigators in *Certification Curriculum Manual, Chapter Five Fire Investigator, 2007 Edition* (TCFP, 2007b). The nexus for the fire investigator curriculum include National Fire Protection Association standards:

- *NFPA 472 Standard for Competence of Responder to Hazardous Materials Incidents, 2002 Edition*
- *NFPA 921 Guide for Fire and Explosion Investigations, 2004 Edition*
- *NFPA 1033 Standard for Professional Qualifications for Fire Investigator, 2003 Edition*

A portion of the curriculum emphasizes laws and statutes of which the fire investigator is required to have a respectable knowledge. A fire investigator does not have the authority to enforce laws unless a law enforcement commission certification is obtained (TCFP, 2007b).

There is no prerequisite to hold a peace officer certification for admission into the Texas Commission on fire protection/fire investigator training. Upon successful completion of fire investigator training, a person will be awarded certification as a fire investigator. If a fire investigator desires or the agency, such as Dallas Fire-Rescue, requires that fire investigators have the authority to investigate arson fires, then the fire investigator must obtain a law enforcement commission certification. Minimum standards for arson investigator certification is stated in the *Standards Manual for Fire Protection Personnel* (TCFP, 2006):

Chapter 431 Fire Investigation, Subchapter A Minimum Standards for Arson Investigator Certification, 431.11 Minimum Standards for Arson Investigator Certification for Law Enforcement Personnel states:

- A law enforcement officer employed or commissioned by a law enforcement agency as a peace officer who is designated as an arson investigator by an appropriate local authority is eligible for certification on a voluntary basis by complying with this chapter.
- An individual holding commission certification as a fire investigator who becomes a law enforcement officer employed or commissioned by a law enforcement agency as a peace officer, and who is designated as an arson investigator by an appropriate local authority will qualify for a similar level arson investigator certificate. To obtain a printed certificate the individual must make application to the commission to include confirmation of commission. (TCFP, 2006)

The Texas Commission on Fire Protection requires a minimum of 20 hours continuing education for fire investigators (TCFP, n.d.b). Most of the continuing education training hours are accomplished during regular on-duty work hours.

H. FIRE SERVICE IFSAC SEAL

The International Fire Service Accreditation Congress (IFSAC) is a non-profit peer-driven organization authorized by the Board of Regents of Oklahoma State University that accredits fire service certification programs and higher education fire-related degree programs (IFSAC, 2010). The goal of this governing body is to increase the level of professionalism in the fire service by verifying that participating programs are adhering to nationally recognized standards such as the National Fire Protection Association Standards (IFSAC, 2005, pp. 1–3). IFSAC has reviewed, approved, and accredited the Texas Commission on Fire Protection's hazardous materials technician and fire investigation certification program (TCFP, n.d.a). The IFSAC seal can be obtained voluntarily for a small fee after an individual has successfully completed and met the requirements for Texas Commission on Fire Protection hazardous materials technician or fire investigator (TCFP, n.d.a). The benefit of an IFSAC seal signifies one as being trained to higher nationally recognized standards (TCFP, n.d.a).

I. POLICE OFFICERS

Texas law enforcement standards for police officers are established by the Texas Commission on Law Enforcement Officer Standards and Education (TCLEOSE) for improving law enforcement proficiency and professionalism (Texas Commission on Law Enforcement Officer Standards and Education [TCLEOSE], 2009a). TCLEOSE is governed by nine commissioners appointed by the governor of the state of Texas for staggered six year terms (2009a). The TCLEOSE Commission is empowered by legislation to enact minimum law enforcement standards in accordance with the *Texas Occupations Code Section 1701.151, General Powers of Commission; Rulemaking Authority,(2):* "Establish minimum standards relating to competence and reliability, including education, training, mental, and moral standards, for licensing as an officer, county jailer, or public security officer;" in addition to other responsibilities (TCLEOSE, 2009a).

Texas Commission on Law Enforcement Officer Standards and Education requires that police officers complete 40 hours of continuing education in a 24 month training cycle stipulated by TCLEOSE (TCLEOSE, 2009b). Normally, Dallas Fire-Rescue arson investigators complete the required continuing education hours during regular on-duty hours.

J. CORE KNOWLEDGE, SKILLS, AND ABILITIES

1. Bomb Technicians

The core knowledge, skills, and abilities (KSA), for bomb technicians are listed in Table 14 and obtained directly from the Hazardous Devices Course Curriculum but designed in a generic format to avoid divulging sensitive information (Federal Bureau of Investigation Bomb Data Center, n.d.). Core KSA define the capabilities and qualifications for the individual to function effectively in the role of a bomb technician and successfully accomplish missions they are tasked with. See Table 14 Hazardous Devices Course Curriculum.

Table 14. Core Knowledge, Skill, and Abilities for Bomb Technicians (After Federal Bureau of Investigation Bomb Data Center, n.d.)

Core Knowledge, Skills, and Abilities for Bomb Technicians
Knowledge of types of improvised explosive devices
Skills to employ render safe procedures on explosive devices
Ability to determine and apply hand entry actions
Ability to apply logical procedures utilizing Electronic Counter Measures when necessary
Ability to safely and effectively conduct routine demolition procedures
Knowledge of types of electrical hazards and effects during demolition operations
Knowledge of types of X-ray equipment
Skills to safely operate X-ray equipment
Ability to interpret X-rays of components and devices
Knowledge of EOD robots, their capabilities, and priority of use
Skills to operate EOD robots and successfully complete specific tasks
Knowledge of effects of an explosion on bomb components
Ability to identify bomb components after detonation
Skills to employ protective measures and protective works
Knowledge of types of equipment of for transporting hazardous devices
Ability to safely plan the transportation of an explosive device
Skills to appropriately transport an explosive device
Knowledge of considerations and factors of rigging system operations

Core Knowledge, Skills, and Abilities for Bomb Technicians
Ability to identify rigging and line techniques used during semi-remote procedures
Skills to employ semi-remote procedures
Knowledge of legal issues affecting bomb technicians
Ability to document information relevant to bombing investigations
Knowledge of principles regarding safe storage of explosives
Knowledge of the threat of bioterrorism and biological agents
Ability to identify Weapons of Mass (WMD) devices
Ability to identify chemical agents, hazards, effects of agents, and first aid procedures
Ability to identify military ordnance and follow through with the proper reporting procedures
Ability to identify nuclear material/hazards, nuclear devices, protective measures, and radiation monitoring techniques
Ability to identify improvised explosives and incendiaries
Knowledge of conventional explosives, explosive classes, types of explosives
Knowledge of military Explosive Ordnance Disposal (EOD) response
Skills to don protective equipment and complete specific tasks
Ability to preplan bomb threat and search procedures
Skill to safely actualize the bomb threat and search procedures
Ability to identify and defeat electrical components of Improvised Explosive Device (IED)
Knowledge of Vehicle Borne Improvised Explosive Device (VBIED) history, components, dynamic disruption considerations

Core Knowledge, Skills, and Abilities for Bomb Technicians
Ability to conduct situational analysis and vehicle evaluation of Vehicle Borne Improvised Explosive Devices (VBIED)
Skills to defeat Vehicle Borne Improvised Explosive Devices (VBIED)
Ability to identify improvised mortars and projected weapons
Ability to demonstrate situational analysis and apply Logic Tree application for render safe techniques
Ability to demonstrate risk assessment and apply to render safe techniques
Knowledge and familiarity of safe disposal procedures and directives
Skills to perform safe disposal procedures using detonation and burning techniques
Ability to identify and special purpose tools and capabilities
Skills to demonstrate remote entry procedures
Knowledge of Percussion Actuated Non-electric (PAN) disrupter capabilities
Skills to utilize PAN and render safe Improvised Explosive Devices (IED)
Knowledge of Suicide Bombers and their modus operandi
Ability to evaluate and conduct situational awareness of Suicide Bombings
Ability to determine uses of remote entry along with advantages and disadvantages
Knowledge and uses of mechanical action fuzes, clocks, and timer application to hazardous devices
Knowledge of DC electricity applications to hazardous devices

2. Hazardous Materials Technician

The core knowledge, skills, and abilities (KSA) for hazardous materials technicians are listed in Table 15 and obtained directly from *NFPA 472 Standard for*

Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents (NFPA, 2008b) and *Section 604 of Certification Curriculum Manual, Chapter Six Hazardous Materials NFPA 472, 2008 Edition, Texas Commission on Fire Protection* (TCFP, 2010a). Core KSA define the capabilities and qualifications for the individual to function effectively in the role of a hazardous materials technician and successfully accomplish missions they are tasked with. See Table 15 *NFPA 472 Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* (After NFPA, 2008b) and *Section 604 of Certification Curriculum Manual, Chapter Six Hazardous Materials NFPA 472, 2008 Edition*.

Table 15. Core Knowledge, Skills, and Abilities for Hazardous Materials Technicians (After TCFP, 2010a)

Core Knowledge, Skills, and Abilities for Hazardous Materials Technicians
General knowledge of laws, regulations, and national standards
Ability to analyze the hazardous materials/WMD (Weapons of Mass Destruction) incident to determine complexity of problems and potential outcomes
Skills to survey the hazardous materials/WMD incident to indentify special containers, storage tanks, railroad cars, non-bulk packaging, and radioactive packaging; indentify or classify unknown hazardous materials; verify the presence and concentrations of hazardous materials through the use of instrumentation, detection and monitoring equipment
Skills to collect and interpret hazard and response information from printed and technical resources, computer databases, and monitoring equipment
Ability to describe the condition of the container involved in the incident and assess the level of risk associated with the damage
Ability to predict the likely behavior of released materials and their containers with multiple materials involved
Ability to estimate the likely size of an endangered area

Core Knowledge, Skills, and Abilities for Hazardous Materials Technicians
Ability to plan a response within the capabilities of available personnel, defining objectives, potential options, and selecting proper personnel protective equipment
Ability to select a technical decontamination process to minimize the hazard
Ability to develop a plan of action for hazardous materials/WMD incident
Skills to implement the planned response to favorably change the outcome
Skills to perform the incident command duties within the local incident management system
Skills to don and effectively function in protective clothing and respiratory protection
Skills to perform control functions identified in the Incident Action Plan (IAP)
Skills to perform decontamination functions identified in the Incident Action Plan (IAP)
Ability to evaluate the progress of the hazardous materials incident/WMD concerning the effectiveness of the control functions and decontamination process
Knowledge to terminate the hazardous materials/WMD incident
Knowledge to assist in the incident debriefing and incident critique
Skills to provide reports and documentation of the hazardous materials/WMD incident

3. Fire Investigator

The core knowledge, skills, and abilities (KSA) for fire investigators are listed in Table 16 and obtained directly from *Certification Curriculum Manual, Chapter Five Fire Investigator, 2007 Edition, Texas Commission on Fire Protection* (TCFP, 2007b). Core KSA define the capabilities and qualifications for the individual to function effectively in

the role of fire investigator and successfully accomplish missions they are tasked with. See Table 16 *Certification Curriculum Manual, Chapter Five Fire Investigator, 2007 Edition, Texas Commission on Fire Protection.*

Table 16. Core Knowledge, Skills, and Abilities for Fire Investigator (After TCFP, 2007b)

Core Knowledge, Skills, and Abilities for Fire Investigators
Knowledge of NFPA Standards 1033 and 921 applicable to Fire Investigators
Knowledge of rules applicable to Arson Investigators certification per Texas Commission on Fire Protection
Ability to describe the nature of fire investigations utilizing the systematic approach of the scientific method
Ability to describe the process of combustion and associated fire science key terms
Knowledge and ability to define/describe fire theory
Skills to identify heat energy sources
Knowledge and ability to define/describe methods of heat transfer
Ability to describe the conditions necessary for ignition of different types of fuel
Ability to describe the effects of fuel load fire development
Skills and ability to identify/describe fire development
Knowledge and ability to define/describe the characteristics of fuels
Skills and ability to identify/describe the characteristics of flammable and combustible liquids
Skills to identify characteristics of oxidizers, plastics, and combustible metals
Skills and ability to identify/describe basic classifications of building construction and the general fire behavior expected for each type of construction

Core Knowledge, Skills, and Abilities for Fire Investigators
Ability to describe the different methods of frame construction and the fire protection concerns associated with each
Ability to describe the different types of alternative residential construction and fire protection concerns associated with each
Ability to describe the effects of fire and fire suppression activities on common building materials
Skills to identify fire spread characteristics of interior finishes
Skills to identify different types of wall/partitions and their characteristics as related to fire spread
Skills to identify construction assemblies and their characteristics as related to fire spread
Ability to describe building systems components and their relation to smoke and fire spread
Ability to describe the types and characteristics of automatic sprinkler systems
Ability to describe the types, operations, capabilities and the effects of the proper application of special agent fire extinguishing systems
Skills to identify the classes and capabilities of standpipe and hose systems
Skills to identify alarm-initiating devices
Skills to identify fire detection systems
Ability to describe Heating Ventilation and Air Conditioning (HVAC) system components and their relation to smoke and fire spread
Knowledge and skills to recognize, identify, and properly analyze fire patterns
Skills to identify and interpret charring
Skills to identify and interpret characteristics of spalling

Core Knowledge, Skills, and Abilities for Fire Investigators
Ability to define oxidation and the effects of oxidation
Skills and ability to identify/describe the effects of heat on common materials
Ability to describe thermal expansion and deformation of materials
Skills and ability to identify/describe: smoke and soot, clean burn, and calcinations
Ability to describe the effects of fire on window glass
Skills to identify and interpret burn patterns on collapsed furniture springs
Skills to identify certain types of burn patterns used to locate the positions of objects as they were during a fire
Skills and ability to identify/describe locations of fire patterns and various fire patterns
Skills and ability to identify/describe linear fire patterns and area fire patterns
Skills and ability to identify/describe material distortion
Skills and ability to identify/describe general considerations of human response to fires
Skills and ability to identify/describe the factors related to fire initiation
Skills and ability to identify/describe human factors related to fire spread
Knowledge to ensure that constitutional considerations are observed and landmark legal cases relating to fire investigation
Ability to identify laws and procedures relating to "right of entry"
Knowledge of laws and procedures relating to evidence
Ability to identify general laws related to the criminal prosecution of fire related crimes

Core Knowledge, Skills, and Abilities for Fire Investigators
Ability to identify laws relating to the reporting of arson statutes and the basic reasons for civil litigation as it pertains to fire investigation
Ability to identify legal requirements for expert testimony
Ability to identify sources of information and assistance available to the Investigator during a fire investigation
Ability to identify government and private sources of information useful during a fire investigation
Skills to identify basic information necessary to plan and conduct an investigation and identify the goals of a pre-investigation team meeting
Ability and skills to perform and document an interview
Ability and skills to document the investigation of the fire scene
Ability and skills to define types of evidence and the purposes for submitting items for analysis
Knowledge and ability to describe methods of preserving and protecting the fire scene and evidence
Knowledge and ability to describe contamination of containers and evidence
Knowledge and ability to describe methods of colleting physical evidence, including types, capabilities and limitations of standard and special tools
Skills and ability to identify/describe the evidence chain of custody, methods of documentation, and proper methods of transporting evidence
Skills to identify types of evidence of analytical methods and tests applicable to certain fire investigations, and the capabilities and limitations of the services that perform the analysis
Knowledge of the proper procedure for evidence disposition
Knowledge of death scene considerations
Skills to identify individuals to be notified and involved in a fatality fire

Core Knowledge, Skills, and Abilities for Fire Investigators
investigation
Skill to identify other possible related crimes associated with fatality fires
Ability to describe the documentation procedure related to the recovery of bodies and evidence
Ability to describe death-related pathological and toxicological examinations
Ability to describe the effects of consumption of the body by fire
Ability to describe the fundamental issues of death investigations, mechanism of death, and postmortem tests and documentation
Ability to describe fire and explosion injuries, medical evidence of burns, medical evidence of inhalation injuries and mechanism of inhalation injuries
Knowledge of hospital tests, documentation and access to medical evidence
Knowledge of safety issues as they relate to the Fire Investigator regarding on scene safety
Knowledge of NFPA Standard 472 applicable to Hazardous Materials incident management and response
Knowledge and skills to identify hazardous classes or divisions and the primary hazards associated with the class or division
Skills to identify typical occupancies and locations where hazardous materials may be manufactured, transported, stored, used or disposed
Skills to identify specialized marking systems found at fixed facilities and a placard on mode of transportation that indicated hazardous materials
Knowledge of material safety data sheets (MSDS) and shipping papers that indicates hazardous materials
Skills to identify clues (other than obvious container markings, location, container shape, shipping papers) that use the senses of sight, sound, and odor to indicate hazardous materials

Core Knowledge, Skills, and Abilities for Fire Investigators
Knowledge and skills to identify locations that could become targets for criminal or terrorist activity using hazardous materials
Knowledge of the difference between a chemical and biological incident
Skill to utilize the *Emergency Response Guidebook*
Skills and ability to identify/describe the proper method of conducting a preliminary scene assessment
Skills and ability to identify/describe the purpose for examining the surrounding areas of a fire scene
Skills to identify items to be noted during the exterior and interior examination of the building
Skills and ability to identify/describe the importance of burn patterns interpretation as it relates to areas of origin
Skills and ability to identify/describe the importance of interpretation of low burns and their relationship to the point of origin
Skills and ability to identify/describe the effects of fire attack, ventilation, salvage, and overhaul as they relate to point of origin determination
Skills and ability to identify/describe responsibilities of fire suppression personnel related to fire investigations
Knowledge and skill to define/identify the purpose of fire scene reconstruction
Skills to identify the method for examining a total burn structure
Knowledge to define fire cause
Skills and ability to identify/describe the process of elimination
Ability to describe the source and form of heat for ignition
Skills and ability to identify/describe the first material ignited

Core Knowledge, Skills, and Abilities for Fire Investigators
Ability to determine the ignition source
Skills to formulate an opinion of fire cause that will withstand the challenge of reasonable examination
Ability to describe methods for analyzing the incident for cause and responsibility
Ability to describe the causes of fires or explosions, causes of damage to property, and the causes of bodily injury or loss of life
Ability to describe the determination of responsibility, failure analysis and analytical tools, timelines for use in analyzing fire cause, system analysis techniques, purpose for mathematical modeling, and the role of fire testing
Knowledge of various types of explosions
Ability to describe the characteristics of explosion damage
Ability to describe the procedures for investigation, security and safety considerations at an explosion scene
Ability to describe procedures used to conduct a post blast investigation
Knowledge and ability to explain electrical theory and indicators of damage to electrical systems
Knowledge to define “accidental” fires
Skills and ability to identify/describe typical causes of accidental fires
Skills and ability to identify/describe product liability and duties of the manufacturer
Skills to identify damaged products
Knowledge of procedures for securing, storing and disposal of damaged products or evidence
Knowledge to define “incendiary” fires
Skills and ability to identify/describe indicators of “incendiary” fires

Core Knowledge, Skills, and Abilities for Fire Investigators
Skills and ability to identify/describe the safe handling procedures when any inactivated incendiary device is discovered
Skills and ability to identify/explain potential indicators of incendiary fires not directly related to combustion
Skills and ability to identify/describe other evidentiary factors associated with incendiary fires
Ability to identify types of motives common to incendiary fire investigation, methods used to discover opportunity and understanding human behavioral patterns relative to fire setting
Skills to identify sources of information relating to vehicles and their operations
Skills to identify safety considerations for conducting motor vehicle examinations
Skills to identify common materials serving as fuels and common ignition sources found in motor vehicle fires
Ability to describe the proper method of examining motor vehicle systems
Skills and ability to identify/describe procedures of recording motor vehicle fire scenes
Skills to identify information to be obtained for the owner/operator and witnesses to establish a vehicle fire scene history
Skills to identify the benefits of examining vehicle particulars and the method of recording the motor vehicle fire scene
Skills to identify items unique to special circumstances involving motor vehicle fires
Skills to identify agencies that provide technical assistance and expertise related to wildfires
Skills and ability to identify/describe flammability analysis of wildfire fuels and factors affecting wildfire spread
Skills and ability to identify/describe/interpret indicators used in determining the

Core Knowledge, Skills, and Abilities for Fire Investigators
direction of travel of a wildfire
Skills to identify methods of conducting an origin investigation of a wildfire
Skills and ability to identify/describe the importance of security of the area or point of origin of a wildfire
Ability to identify causes of wildfires
Skills to identify special safety considerations associated with investigation of wildfires
Ability to manage major investigations and coordinate actions of different parties
Skills and ability to identify/describe the components of managing a major investigation
Ability to identify the purpose of the post-scene analysis
Ability to describe the purpose of collecting and organizing investigative material, the purpose of review and evaluation of investigative material, and the types of data regarding a fire loss problem and their use in developing public informational presentations

4. Police Officer

The review of law enforcement curriculum for developing the core knowledge, skills, and abilities is incommensurate for this research and concentration on fire service special operations teams. There is no requirement for a bomb technician or fire investigator to hold a law enforcement commission. However, the cost of training and training hours will be relevant to factor in the overall expense of the Dallas Fire-Rescue Explosive Ordnance Disposal Team because of the agency requirement.

K. COST OF TRAINING

The cost of training a Dallas Fire-Rescue bomb technician will not have the budgetary impact of paying backfill (replacement staffing cost) for the vacant position the member attending school creates. Approximately three members assigned to 40-hour

work week staff assignments have been selected for explosive ordnance disposal training. No minimum staffing requirement is necessary to backfill a staff assignment or pay overtime, so the practice within Dallas Fire-Rescue has been to temporarily maintain the vacant position until the member returns from training.

1. Hazardous Device School

Hazardous Device School (HDS) is located in Redstone Arsenal, Huntsville, Alabama. There are no tuition fees for Hazardous Device School courses (Jernigan, 2006). The basic course is six weeks in length and cost will be incurred for air travel, lodging, rental car, and per diem, which will be estimated following financial policies and procedures via the City of Dallas Administrative Directive 4-7, Travel on City Business, and factored into the overall cost of training one person as a bomb technician (City of Dallas, 2004b). After the justification is written for the person attending Hazardous Devices School and approved by the proper city official, airline tickets and rental car arrangements will be secured by the most economical means. Maximum federal lodging, meal, and incidental expense per diem rates will be paid in conformity with the rates indentified by the Internal Revenue Service Publication 1542 (City of Dallas, 2004b). The city uses the U.S. General Services website to locate the maximum rates allowed for the destination of the traveler (City of Dallas, 2004b). See Table 17.

Table 17. Cost for Training a Bomb Technician

	Length of HDS Class	Airfare to Huntsville, AL	Rental Car	Lodging	Per Diem
Per Person	6 weeks	$585.40	$1,415.27	$3,526.00	$2,116.50
				Total Cost Per Person	**$7,643.17**

2. Hazardous Materials Technician

In order to figure an accurate estimated cost for training hazardous materials technicians a few substantial factors bear consideration, such as locating and selecting an accredited Texas Commission on Fire Protection hazardous materials technician class with reasonable tuition rates and finding scheduled classes that coincide with a time-frame that allows for temporary vacancy of staff personnel as well as meeting departmental needs. A hazardous materials technician course is offered locally and is 80 hours in length for two weeks at eight hours per day; refer to Table 18 for costs (Tarrant County College Fire Service Training Center, n.d.b).

The city of Dallas follows the standard mileage rates established by the Internal Revenue Service. The current IRS standard mileage rate of 51 cents per mile will be used for estimating mileage reimbursement cost (IRS, 2010). Actual mileage for DFR members attending training locally will be calculated from each member's normal work assignment to the location of the class. The mileage estimate used for Table 18 is calculated from the Dallas Fire Rescue Training Academy to the location of the scheduled hazardous material technician class.

The Texas Commission on Fire Protection charges a standard fee of $35.00 for each application for certification once the Hazardous Materials Technician has successfully passed the commission exam (TCFP, n.d.b). After the $35.00 fee is received and processed the TCFP will send the HMTs certificate of certification to Dallas Fire-

Rescue and update the commission's database to reflect each individual that possesses a Hazardous Materials Technician Certificate (TCFP, n.d.b).

Another significant cost that must to be figured into the overall cost of training personnel is an initial medical physical. *Code of Federal Regulations 29 CFR 1910.120 (f)(3) Medical Surveillance*, directs employers to establish a medical surveillance program requiring hazardous materials technicians to undergo a medical physical every 12 months (United States Department of Labor, 2011).

At the time of this research, Dallas Fire Rescue does not have a hazardous materials technician medical surveillance vendor contract for 2011, but a request proposal for medical surveillance has been submitted to the DFR Financial Services Assistant Director. The city purchasing agent has not completed the bid process for the medical physicals. According to past medical surveillance records protected under the Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy and Security Rules and kept by the Hazardous Materials Coordinator, the current proposal for medical physicals could be estimated at a cost of approximately $1,900.00 per individual physical. This is the figure that will be used to factor in the total cost of training a DFR hazardous materials technician. Refer to Table 18.

Table 18. Cost for Training a Hazardous Materials Technician

	Cost of Hazardous Materials Technician Class	Length of Class	Mileage Cost	TCFP Test Certification Fee	Initial Hazardous Materials Technician Medical Physical
Per Person	$580.00	80 hours	$435.50	$35.00	$1,900.00
				Total Cost Per Person	**$2,950.50**

3. Fire Investigator

Dallas Fire-Rescue has the capability to conduct a fire investigator course in-house. The course is six weeks in length, which fulfills the Texas Commission on Fire Protection minimum recommendation of 150 hours instruction (TCFP, 2007b, p. 1). There is a minimal cost per student for books and a fee to the Texas Commission on Fire Protection for fire investigator certification once the member has successfully completed the course. See Table 19.

Table 19. Cost for Training a Fire Investigator

	Length of Fire Investigator Course	Cost of Books per Person	Texas Commission on Fire Protection Test Fee
Per Person	6 Weeks	$155.00	$35.00
		Total Cost per Person	**$190.00**

4. Police Officer

Dallas Fire-Rescue enrolls personnel in the Dallas Police Academy for police officer training. The Dallas Police Department (DPD) Web-site lists the Dallas Police Academy training as 32 weeks. However, in a conversation with a DPD Academy representative, the training has recently been increased from 32 weeks to 34.5 weeks because of new mandated courses by the Texas Commission on Law Enforcement Officer Standards and Education (TCLEOSE) and new courses DPD added. There is no cost to Dallas Fire-Rescue for tuition, but there is a fee for equipment. According to the Dallas Police Department Quartermaster, the equipment necessary for police training is a ballistic vest, duty belt, weapon, holster, handcuffs, handcuff holder and key, and clips for ammunition, which amount to $1,487.13. The *Texas Commission on Law Enforcement Officer Standards and Education Rules Handbook* (2010) states there is no fee collected for peace officer certificates (TCLEOSE, 2010, p. 95). See Table 20.

Table 20. Cost for Training a DFR Fire Investigator to Police Officer Level

	Length of Dallas Police Academy	Cost of Equipment for Training
Per Person	34.5 weeks	$1,487.13
	Total Cost per Person	**$1,487.13**

The research for the individual cost of each vocation is compiled in Table 21 to reflect Dallas Fire-Rescue's agency requirement for training one bomb technician.

Table 21. Total Cost for Training a Bomb Technician in Multiple Vocations

Dallas Fire-Rescue Vocation Requirement	Total Cost for Training one (1) Person per Vocation
Hazardous Devices School	$7,643.17
Hazardous Materials Technician	$2,950.50
Fire Investigator	$190.00
Police Officer	$1,487.13
Total Cost for Training one (1) Bomb Technician in all Vocations	
$12,270.80	

L. EVALUATION OF EXPLOSIVE ORDNANCE DISPOSAL TEAM HOMELAND SECURITY ROLE

The *National Strategy for Homeland Security 2007* points up the nation's vulnerability to improvised explosive devices (IED) and considers them a high priority threat (DHS, 2007b, p. 20). Improvised explosive devices are homemade explosives (HME) assembled with conventional components to create an unconventional weapon (Global Security, 2011). IED can be as simple or sophisticated as the imagination of the

designer with the materials available to them (Global Security, 2011). The range of variance in unconventional weapons increases the difficulty in detection and protection against them (Global Security, 2011).

The rationale of countering the threat of explosive attacks against the United States prompted the national policy, *Homeland Security Presidential Directive 19: Combating Terrorist Use of Explosives in the United States* (DHS, 2009). The directive specifically states:

> Terrorists have repeatedly shown their willingness and ability to use explosives as weapons worldwide, and there is ample intelligence to support the conclusion that they will continue to use such devices to inflict harm. The threat of explosive attacks in the United States is of great concern considering terrorists' ability to make, obtain, and use explosives, the ready availability of components used in IED construction, the relative technological ease with which an IED can be fashioned, and the nature of our free society. (DHS, 2009)

Explosive ordnance disposal (EOD) teams are the homeland's frontline defense for countering the threat of explosive attacks against the United States.

EOD teams have the best training and capabilities to fulfill the aggressive counter threat policy laid out in *Homeland Security Presidential Directive 19: Combating Terrorist Use of Explosives in the United States* (DHS, 2009). Civilian bomb technicians receive training through the joint efforts of the FBI and U.S. Army at one training facility, the Hazardous Device School (Jernigan, 2006). Training bomb technicians using established national standards at one facility ensures a high caliber of professional training through the identical consistent delivery of one curriculum.

National Bomb Squad Commanders Advisory Board (NBSCAB), the final regulatory authority on EOD teams and bomb technicians, has worked collaboratively with other federal agencies that have a strong interest in EOD teams to create and authorize (NBSCAB, n.d.a):

- Standard equipment list and approved equipment list for EOD teams
- Mandatory requirement of robots to bomb squads
- Weapons of mass (WMD) equipment

- Guidelines for explosive detection canines
- Critical Incident Response and Technology Seminar (CIRTS) program
- Radio Controlled Improvised Explosive Device (RCIED) program
- Computer-related support to bomb squads (i.e., wireless laptop, software, technical database)
- Development of strategies for Vehicle Born Improvised Explosive Device (VBIED), suicide bomber, and utilizing Radio Controlled Improvised Explosive Device (RCIED) technical and operational plans to design a corroborative national Electronic Countermeasures (ECM) program (NBSCAB, n.d.a)

The consistency in EOD Teams' equipment, training, and standards for accreditation sets a benchmark for accuracy in successfully completing any mission EOD Teams are assigned.

Bomb technicians and EOD teams can share explosive-related information via a national database created by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) called Bomb Arson Tracking System (BATS) (Robinson, 2009). The Bomb Arson Tracking System is recognized by NBSCAB as the designated repository for explosive-related incident reporting (Robinson, 2009).

The BATS database allows EOD teams to access, retrieve, and contribute information necessary to stay apprised of explosive analysis and intelligence nationwide. This collaborative effort among all governmental levels and jurisdictions to share information is in-line with the expectations of *National Strategy for Homeland Security 2007* (DHS, 2007b)

> …developing a common baseline for law enforcement activities (e.g., standardizing information collection and collation, reporting procedures, and data archiving across all jurisdictions in order to improve analysis and detection of emerging threats or patterns) so that they may work together seamlessly throughout the Nation. This common approach must be capable of tailoring activities at each level to support specific priorities of importance to their respective communities and, as necessary, be able to fulfill select requests for information as part of the broader national effort to the Homeland. (DHS, 2007b, p. 50)

Like most special operations teams, EOD teams are made up of volunteers. According to the authors of the book *Bomb Squad*, who were embedded for a year with the New York Police Department (NYPD) Bomb Squad, countries outside the United States seek to kill bomb technicians because they are a threat to the terrorist bomb detonating successfully (Esposito & Gerstein, 2007). So, why do people volunteer to become bomb technicians and members of EOD teams? The authors of *Bomb Squad* found the answer to this question during one of their interviews:

> Why do bomb technicians stand over these devices so willingly? Thirty-three times that question was asked of the NYPD Bomb Squad members and thirty-three times the Bomb Squad member's answer was the same: "Somebody has to do it." (Esposito & Gerstein, 2007, p. 95)

V. PART I ANALYSIS OF DFR SPECIAL OPERATIONS TEAMS

A. KNOWLEDGE, SKILLS, AND ABILITIES (KSA) JUXTAPOSITION

The importance of special operations team members mastering the knowledge, skills, and abilities (KSA) of numerous tasks during training courses is acquiring competency in performing complex job assignments for which standard operating procedures (SOP) may not exist because of the rarity and peculiarity of the event. The challenge is maintaining the KSAs once the initial training is completed. Competencies of special operations team members also include possessing attributes in rapid decision making during dynamic situations with a high potential for a cascading failure effect. The competency of special operations teams points to the adeptness in applying knowledge and using resources available to deescalate a catastrophic event rapidly and efficiently. The research shows that numerous hours and abundant money are spent by departments to send personnel to specialized training courses for higher level learning and competency in various technical subjects. In analyzing the KSAs of all Dallas Fire-Rescue special operations teams listed within the tables of this thesis to determine if there is a better way to achieve efficiency in special operations missions, two questions are relevant:

1. Is an identifiable paradigm or coequal feature present in the core KSAs that suggest some curriculums could be combined for initial training purposes?
2. Does the curriculum KSAs provide the guidance necessary for high-risk decision making?

In response to the first question, training must be defined and understood. According to Clark in *Instructional System Design Concept Map* (as cited in Nadler, 1984), "Training is defined as learning that is provided in order to improve performance on the present job" (Nadler, 1984). Clark continues to elaborate

> ..this differs from a few other definitions in that rather than "training" being used as a verb—to train, it defines it from the learners' action—an activity that they perform. Performance is improved by helping the

> learners to master a new or established technology. The technology may be a piece of heavy machinery, a computer, a procedure for creating a product, or a method of providing a service. Notice that the last part of the definition states that training is provided for the present job. This includes training new personnel to perform their job, introducing a new technology, or helping an employee to achieve standards….Note: We often think of technology as computers, electronics, etc., but it is much more. The Merriam-Webster dictionary defines technology as the practical application of knowledge, especially in a particular area. It includes the usage and knowledge of tools, techniques, and crafts, or is systems or methods of organization. (Clark, 2004)

Next, embedded in the training curriculum are the job tasks that require an individual have the knowledge, skills, and abilities to perform. Clark states, "A task is a well-defined unit of work. It stands by itself. It is a logical and necessary action in the performance of a job or duty. It has an identifiable start and end point and results in a measurable accomplishment or product" (Clark, 2004). Tasks are the functions necessary to perform the job (e.g., technical rescue, render a bomb safe, manage a hazardous material incident, or determine the origin of a fire).

The KSAs are developed from training curriculum based on national standards that are accredited by non-profit organizations and recognized as professional qualification standards. In higher standards of training a job hazard analysis has been conducted on the job tasks (OSHA, 2002).

> A job hazard analysis is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools, and the work environment. Ideally, after you identify uncontrolled hazards, you will take steps to eliminate or reduce them to an acceptable risk level. (OSHA, 2002, p. 1)

Comparing all Dallas Fire-Rescue special operations teams core KSAs, an identifiable paradigm or coequal feature is not present to suggest the curriculums could be combined for initial training purposes. This is evident because the job hazard analysis has a direct relationship with the specific job tasks (which are the known hazards for the tasks) embedded in the core KSAs of each training curriculum presented in this research. It is important to have the baseline knowledge and understanding of the known hazards in order to figure out how to appropriately adjust for the unknown hazards that can be

encountered during high-stress, challenging situations. Furthermore, the tasks are specific and measurable to the function of each training curriculum. Combining training curriculums for first-time students could result in confusing sequences of a task, missing identifiable job hazards, and learners failing to demonstrate proficiency in performing tasks effectively to the expected national standards.

Firefighters attending primary training courses should fundamentally master the skills being taught to perform the job effectively. Skills are another baseline component that requires comprehensive understanding. According to author Neitzel (2006):

> A skill is defined as an action required in order to perform a task that involves coordination of body movements. In a sense, it is nothing more than the application of a worker's knowledge. Knowledge is defined as an understanding of facts, principles, or concepts, including the cognitive process necessary to process information. (Neitzel, 2006)

When firefighters learn the information taught in a formal training course, they develop a basic mental script of the experience. The human memory uses knowledge structures to organize the information they have learned (Schank & Lyras, 2008). As stated by Schank and Lyras, a script is sequential set of facts regarding a specific situation learned by undergoing the experiences of performing or doing something: "Higher level, more abstract notions, enable learning because they allow sharing of knowledge across script boundaries" (2008). Firefighters need this baseline script of knowledge in order to proceed across script boundaries to higher-level learning and expand their knowledge scripts through continued education.

In response to the second question, even though the tasks and known hazards are structured for a specific training curriculum, mixed and unpredictable circumstances can arise necessitating the use of one's judgment. It would be impossible to codify all tasks of special operations into procedures for a comprehensive decision-making tool (Klein, 2009, p. 19). According to Klein, the author of *Streetlights and Shadows Searching for the Keys to Adaptive Decision Making*, "Procedures can lull people into a passive mindset of just following the steps and not really thinking about what they are doing. When we become passive, we don't try to improve our skills" (2009, p. 22). Klein further offers:

> Research supports this idea of eroding expertise. A number of studies have shown that procedures help people handle typical tasks, but people do best in novel situations when they understand the system they need to control. People taught to understand the system develop richer mental models than people taught to follow procedures. (2009, p. 23)

Procedures may have their limitations, but there are certainly benefits to having the baseline knowledge and understanding of procedures (Klein, 2009):

1. Initial training tool for personnel
2. Memory aid to get personnel started in the direction of solving the problem
3. A starting point or reference of where to begin
4. Reduce stress and workload for the less complicated part of the problem
5. Coordinate some consistency within teams when everyone knows the procedures. (Klein, 2009, pp. 28–29)

Special operations teams will need standard operating procedures (SOP) as well as the ability and latitude to use one's judgment when the complex situation escalates beyond the SOP. However, people trained to understand the system, the limitations of their equipment, and known hazards are more flexible and will recognize complex situations whereas people trained to follow procedures will not (Klein, 2009).

The national standard that training curriculums are based on is not intended to be all inclusive of the knowledge essential to eradicate risks. The National Fire Protection Association (NFPA) states its code and standards are "intended to minimize the possibility and effects of fire and other risks" (NFPA, 2011). The NFPA standards are used as minimal or basic accepted measures to guide the nation's fire service personnel in performing overall job tasks. As a result the KSAs developed from the national standards are utilized as methods when training people to understand the system as well as the tasks. Mastering the KSAs of the curriculum will arm the individual with explicit knowledge (facts and guidelines) and encourage tacit knowledge (a repertoire for skills and experience) in making high-risk decisions (Klein, 2009).

B. SPECIAL OPERATIONS TEAMS AND CONTINUING EDUCATION HOURS

Budget and cost will be a factor when considering training personnel for a special operations team assignment. A detail to take into account is how to keep the personnel adequately trained in a job assignment that is labeled as low-frequency/high-risk once the initial training is completed. Minimum continuing education (CE) hours are required so as to remain in accordance with the rules and regulations set forth by the governing agency issuing the special certification. Dallas Fire-Rescue has the option of increasing the minimum CE hours for adeptness and competency. The CE hours for Dallas Fire-Rescue special operations teams are listed in Tables 22–24 for comparison.

Table 22. DFR Hazardous Materials Response Team Annual Continuing Education Hours

DFR Hazardous Materials Response Team Continuing Education Hours	
Structural Firefighting	20 hours
Hazardous Materials Technician (Emergency Operations Assignment)	20 hours
DFR Hazardous Materials Response Team Continuing Education Total Annual Training Hours 40	

Table 23. DFR Urban Search & Rescue Annual Continuing Education Hours

DFR Urban Search & Rescue Continuing Education Hours	
Structural Firefighting	20 hours
Urban Search & Rescue	40 hours
DFR Urban Search & Rescue Continuing Education Total Annual Training Hours 60	

Table 24. DFR Explosive Ordnance Disposal Team Annual Continuing Education Hours

DFR Explosive Ordnance Disposal Team Continuing Education Hours	
Explosive Ordnance Disposal Practical Exercise/Training 16 hours Monthly	192 hours
Explosive Ordnance Disposal	40 hours
Hazardous Materials	10 hours
Fire Investigator	20 hours
Police Officer	20 hours
DFR Explosive Ordnance Disposal Team Continuing Education Total Annual Training Hours 282	

Another consideration with regard to training is mandatory departmental-wide training, including: emergency medical services (EMS), leadership seminars, new technology updates (e.g., computer-aided dispatch system, National Fire Incident Reporting System (NFIRS) new equipment, and new or updated procedures. Departmental-wide training will decrease the number of on-duty training hours available for mandatory continuing education making it necessary to reschedule the missed CE training day. One other mandatory training aspect that impacts Emergency Operations Division personnel assigned to special operations teams (hazardous materials technicians

and urban search & rescue) is two training and evaluation phases for four hours per session a calendar year (DFR, 2008, p. 302). The training and evaluation phase will not have a bearing on the training hours for the Explosive Ordnance Disposal Team because they are not firefighters or assigned to the Emergency Operations Division.

In comparing the total amount of continuing education hours for special operations teams, the overarching question is: Can special operations teams realistically complete the required number of continuing education hours while on-duty? The Hazardous Material Response Team (HMRT) and Urban Search & Rescue (US&R) Team perform dual roles for Dallas Fire-Rescue. As firefighters they work 24 hour shifts and respond to fires, emergency medical services (EMS), hazardous materials, and urban search & rescue incidents. The priority next to emergency response is completing all training.

The shift schedule 24/48, which is 24 hours on and 48 hours off, allows approximately 121–122 shifts in a calendar year for a firefighter to work; however, due to scheduled leave (vacation, holidays, Kelly days) firefighters are available for duty approximately 103 shifts a year. Most training is conducted within an eight-hour window during weekdays and there is no minimum training requirement on weekends or holidays. Weekends can be used for make-up mandatory continuing education, if deemed necessary by the station officer. Other mandatory departmental-wide training is conducted during weekdays only because of instructor availability (DFR, 2008, pp. 293–310). Taking this into account, there are aves approximately 87 shifts available for completing all mandatory training.

The hazardous material technician (HMT) assigned to the Hazardous Materials Response Team is required to complete 40 hours of continuing education a year. If the HMT actually worked 103 shifts a year, he/she would have to study 23 minutes a shift to meet the 40-hour CE requirement. If the HMT working 103 shifts were to study on weekdays only, reducing the number of shifts to 87 weekday shifts, he/she would have to study 28 minutes each shift to satisfy the 40-hour requirement. See Table 25.

The Urban Search & Rescue (US&R) Team member is required to complete 60 hours of continuing education a year. If the US&R member actually worked 103 shifts a year, he/she would have to study 35 minutes a shift to meet the 60-hour CE requirement. If the US&R member working 103 shifts were to study on weekdays only, reducing the number of shifts to 87 weekday shifts, he/she would have to study 41 minutes each shift to satisfy the 60-hour requirement. See Table 26.

Bomb technicians/arson investigators (as proposed in the Bomb Squad Transition Plan explained in Chapter IV) will perform dual roles and respond to all threats, potential or actual incidents regarding all types of incendiary devices, explosives, or bombings, render devices safe and/or dispose of them, collect evidence, submit prosecution reports to the proper authority, conduct investigations, provide dignitary protection, and respond in the 16-county region when called (Homeland Security and Operations Division, 2009). In the arson investigator role he/she will investigate and determine all fire causes in the city of Dallas, make emergency responses to multiple alarm fires, when special called by incident commanders, fire fatalities, serious burn victims, and when requested by the Dallas Police Department for criminal activity involving fire (DFR, 2003). Other non-emergency activities include the authority to investigate, question witnesses, arrest suspects, and testify in court concerning incidents they have participated in (DFR, 2003). Training is a priority next to all daily duties.

As bomb technicians/arson investigators the shift schedule is 24/72, that is 24 hours on and 72 hours off, allowing approximately 91–92 shifts in a calendar year for them to work; however, due to scheduled leave (vacation, holidays, Kelly days) they are available for duty approximately 76 shifts a year.

Bomb technicians/arson investigators are required to complete 282 hours of continuing education a year. If the bomb technician/arson investigator actually worked 76 shifts a year, he/she would have to study 3.7 hours a shift to meet the 282-hour CE requirement. If the bomb technician/arson investigator working 76 shifts were to study on weekdays only, reducing the number of shifts to 65 weekday shifts, he/she would have to study 4.3 hours each shift to satisfy the 282-hour requirement. See Table 27.

Table 25. Continuing Education Study Time Necessary for DFR Hazardous Materials Technician

Hazardous Materials Technician Shift Schedule 24/48 40 Continuing Education Hours Annually	
Available annually for 103 Shifts	Must study **23 minutes** per shift to complete 40 hours
Studying weekdays only decreases to 87 Shifts	Must study **28 minutes** per shift to complete 40 hours

Table 26. Continuing Education Study Time Necessary for DFR Urban Search & Rescue Members

Urban Search & Rescue Shift Schedule 24/48 60 Continuing Education Hours Annually	
Available annually for 103 Shifts	Must study **35 minutes** per shift to complete 60 hours
Studying weekdays only decreases to 87 Shifts	Must study **41 minutes** per shift to complete 60 hours

Table 27. Continuing Education Study Time Necessary for DFR Bomb Technician/Arson Investigator

Bomb Technician/Arson Investigator Shift Schedule 24/72 282 Continuing Education Hours Annually	
Available annually for 76 Shifts	Must study **3.7 hours** per shift to complete 282 hours
Studying weekdays only decreases to 65 Shifts	Must study **4.3 hours** per shift to complete 282 hours

The study time per shift in Tables 25–27 offers the best case scenario in expressing how much time is necessary per shift to satisfy the required CE hours annually. No consideration was given to sick time, injured time, attendance incentive leave day, emergency incident that lasts through several operational periods, a day spent in court testifying, or other fire department business that may take priority and cause continuing education training to be rescheduled.

Of the three special operations teams listed in Tables 25–27, two of the teams prove to have adequate available on-duty time to realistically complete the required continuing education hours, hence developing subject matter experts (SME) in those fields. The bomb technician/arson investigator will present a challenge for the department in developing SMEs.

Even though special operations teams' missions are high risk, the significance of the mission being conducted by subject matter experts rather than exemplary performers will lower the risk of the mission (Tucker & Lamb, 2007, p. 151). In accordance with Clark's work, subject matter experts are the masters of their craft (2004). They know and understand the order of steps to perform tasks, speak technical-jargon, comprehend acceptable performance objectives, and perform all tasks to an expected higher level of standards (Clark, 2004). SMEs become proficient through numerous hours of training, studying, scenario-based training, and on-the-job experience. On the contrary, "exemplary performers are able to perform the tasks and are worthy of imitation, but do not have a great deal of knowledge about the peripherals surrounding the subject or task" (Clark, 2004).

The excerpt below from *Bomb Squad: A Year Inside the Nation's Most Exclusive Police Unit*, portrays the importance of having, developing, and keeping the right amount of subject matter experts on an explosive ordnance disposal team (Esposito & Gerstein, 2007). Author's note: Esposito and Gerstein published *Bomb Squad A Year Inside the Nation's Most Exclusive Police Unit* in 2007; however, the Hazardous Device School Basic Course was expanded to six weeks in 2005 to include robotics training (Jernigan, 2006).

> As the year went on and more bombs exploded and a Republican convention in New York loomed, a series of police executives offered Lieutenant Torre proposals to increase the NYPD Bomb Squad size. Several of these were based on ideas about what a Bomb Squad does, which included deterrence, boosting public confidence, teaching bomb awareness courses, and creating an omnipresence. Within two weeks after joining the squad, we understood the explanations of why not only were more officers unnecessary, but having too many reduced the chance that each officer would get enough time in the field—time on packages, to stay sharp. Meetings were scheduled to consider whether the squad ought to at least have another dozen dogs—at these meetings the costs of training, feeding, and housing the dogs were discussed. Lieutenant Torre explained that the number of dogs in the squad was designed to complement the number of teams in the field. More dogs were not needed to detect bombs.
>
> A Bomb Squad's job, its only job, was detecting bombs and rendering them safe. For this, a few dozen men and a dozen or so dogs were a far more efficient unit than one that had increased its size to encompass secondary roles. The lieutenant did not want anyone in the squad to take his eye off the job of defusing bombs or the requirement to maintain his own skills through rigorous training. For the younger bomb technicians, the training process takes two years. It began months before any NYPD apprentice bomb tech was even sent to the U.S. Army—FBI Hazardous Devices School in Huntsville, Alabama, where he would earn his "license to die" in a five week basic course. It continued for months afterward to ensure that the techs knew more than just enough to get blown up. Post-HDS, training was relentless, even though many of the NYPD bomb techs had already been hardened as Marines with tours in Afghanistan and the Gulf, or as Air Force EOD men, Army Rangers, and Navy SEALS, specialties where explosives detection and defusing often were at the center of the job. (Esposito & Gerstein, 2007, pp. 60–61)

One could argue that continuing education can be applied to multiple training categories. For instance, during continuing education classes when hazardous chemicals and explosives are being discussed and reviewed, or studying the value of proper investigative techniques, there is probably little doubt that one could take continuing education credit in each category (e.g., hazardous materials and explosive ordnance disposal, or fire investigator and police officer). However, in striving for optimal education and training to develop subject matter experts rather than exemplary performers, the instructor will have to assess and determine: the student's degree of knowledge, ability to perform to the national standards, and the student's skill level when

performing tasks. Next, it will be necessary for the instructor to adjust his/her didactics to meet the optimum educational needs of the students. As stated in the *Systems Approach to Training (SAT) Manual,* the goal of instruction is, "For a learning outcome to be achieved, instruction must be effective and efficient. Instruction is effective when it teaches learning objectives based on job performance requirements and efficient when it makes the best use of resources" (United States Marine Corps, 2004, p. ii). There are many variables to consider before checking the box showing credit in multiple training categories. Finally, training and education will only be as good as the instructor delivering the content of the material.

VI. PART II ANALYSIS OF DFR SPECIAL OPERATIONS TEAMS STATUS QUO/SEPARATE TEAMS

A. FEASIBILITY FROM THE FIRE SERVICE STANDPOINT AND THE PRACTICALITY OF SPECIAL OPERATIONS TEAMS IN THE FIRE SERVICE

If special operations teams were not in the fire service, where would they reside? Common sense and logic place special operations teams as a resource within the fire service. Emergency response is an involuntary reflex in the fire service culture, similar to the learned behavior of Pavlov's dogs reacting by salivating to the ringing of a bell in anticipation of food being delivered. When an emergency run is dispatched over station speakers, house bells are sounded to alert firefighters to take their assigned positions on emergency apparatus and respond with flashing lights and sirens blaring. Their reflexes have been trained to automatically react to the sound of bells ringing and anticipate preparing to engage for mitigating some type of threat deemed immediately dangerous to life and health (IDLH) event. This human behavior is learned over time and firefighters become conditioned (by remaining calm and restrained) while anticipating and preparing to intervene in crisis situations.

Firefighters pride themselves on swift response times. They arrive without delay to the emergency incident and dismount their apparatus in protective gear, with tools and equipment ready to perform any action necessary to bring relief to the situation. Firefighters are a tightly knit group of individuals with various talents that are trained in basic rescue techniques. Firefighters continuously refresh and enhance their basic training skills through continual study of building construction, elevators in high-rise buildings, hazardous materials, rope skills, and survival techniques in saving our own (Norman, 2004). Firefighters have the perfect foundation for supplemental training in highly specialized topics (Norman, 2009, p. 4).

As stated in *Fire Department Special Operations*, the leading reason that special operations teams are feasible and practical in the fire service is their capability to respond to incidents that are not on fire, have a potential to catch on fire, or actually on fire (Norman, 2004, p.4). Firefighters can mitigate any/all of these incidents because of their equipment, tools, and capabilities. As reported by Norman, fire is the main cause of structure collapse, sometimes trapping firefighters and/or civilians (2004, p. 4). He further asserts that confined space rescues may or may not involve working in toxic atmospheres (Norman, 2004). The only trained personnel capable of dealing with a rescue situation this critical are firefighters (2004). Firefighters are not held back by toxic atmospheres (fire or no fire) because their protective gear includes a self-contained breathing apparatus (SCBA) (Norman, 2009, pp. 4–5). The fire service remains unrelenting in its efforts to continue preparedness, interdiction, response, and recovery efforts for all potential critical incidents through daily training requirements.

It is impractical to reason that special operations teams such as urban search & rescue, explosive ordnance disposal, and hazardous materials response teams can be accurately assessed based on response numbers. Quantitative renderings of a utility based solely on the number of operational runs these specialized teams make are inaccurate and shortsighted. Special operations teams respond to what is known in the business as high-risk/low-frequency events and most decision-makers in the fire service base the need for a station location or apparatus placement/relocation generally on the number of runs dispatched to the area. Another fallacy is using fire and/or emergency medical services (EMS) incidents by which to measure special operations teams' response. There is no correlation in analyzing high run volumes (fire and EMS run statistics) to what is already known as low-frequency events.

The evaluation of special operations teams incidents should be examined by disclosing the actual run data. The interpretation of the incident data should include:

- The nature of the incident and why it happened
- True on-scene time
- What actually transpired during the incident

- Tools and equipment used including other special call resources summoned to the incident
- Number of lives saved
- Other disciplines involved in the incident
- Stakeholders involved
- Other city departments involved
- Other jurisdictions involved
- Conclusion of the incident
- Ramifications of the incident

Using the parameters above will supply what is needed for an accurate evaluation and study of special operations incidents. Subsequently, the information can define areas of justification and support for special operations teams because basic firefighting companies do not possess advanced technical rescue skills or capabilities.

B. SPECIAL OPERATIONS TEAMS CAN COMPLEMENT OR SUPPORT OTHER SPECIAL OPERATIONS TEAMS

Military Special Operations Command (SOCOM) has a dogma "equip the warrior, not man the equipment" that places the human element of Special Operations Forces (SOF) as the top priority rather than technology (Tucker & Lamb, 2007, p. 149). Fire service special operations teams abide by this same dogma through the rigorous training regimen they follow in checking, maintaining, calibrating, and learning the high-tech equipment they carry because they have to be able to improvise if the technology fails. Hence the human element must take over and transcend beyond the limitations of just relying on technology. Facing these challenges pushes special operations members to become subject matter experts and develop distinguishing characteristics of endurance.

Special operations teams complementing or supporting other special operations teams can be the best option for the worst case scenario. This is made apparent during incidents when the Hazardous Materials Response Team (HMRT) lends their proficient knowledge of hazardous substances to support the Explosive Ordnance Disposal (EOD) Team. In addition, HMRTs can offer equipment that is unavailable to EOD teams that

can be an invaluable asset to bomb technicians in mitigating the response scene. When HMRTs supply equipment (e.g., monitors, instrumentation, and detectors) for EOD teams, the hazardous materials technician (HMT) will have to decipher the readings. Deciphering the readings will not solidify an irrevocable determination of a hazardous substance.

It is a misconception to believe that handheld hazardous materials instrumentation/detection units will provide a clear reading of identifiable hazardous substances (Noll, Hildebrand, & Yvorra, 2005). Sophisticated technological devices have limitations. For example, handheld devices may show a positive "hit" on any element in the chemical chain of a substance without identifying the particular substance (Noll, Hildebrand, & Yvorra, 2005, pp. 292–297). Now it is up to the hazardous materials technician through additional diagnostics to further dissect the possibilities of the hazardous substance. Basically, the HMT will have to examine the possibilities in reverse order, meaning ruling out what the hazardous substance is not. A HMT that incorrectly interprets a reading from any instrumentation could be exposing all personnel to an environment that is immediately dangerous to life and health (IDLH).

The veracity is that bomb technicians are not hazardous materials technicians but do have an understanding of hazardous substances and explosive materials. A bomb technician's job is to determine the consequence of a device by choosing the best method to ultimately render the device safe and neutralize the incident. Conversely, hazardous materials technicians do not go down range, or in other words handle bombs/explosives in any way at all to attempt rendering a device safe.

Consider Dallas Fire-Rescue (DFR) EOD and HMRT as a case in point of how these teams can collaborate during an EOD suspicious package type response. Currently, the EOD Team does not have any radiation detection equipment. The HMRT can provide this equipment to the EOD Team. The radiation detection device can be attached to the robot but operated by the bomb technician. Once the robot returns with the device a hazardous materials technician can interpret the reading and advise the EOD Team of the known hazardous risks of the situation. Considering this information collectively, the teams can discuss the possible options and incident action plan (IAP). The HMRT can

provide support by estimating and preparing hot to cold zone perimeters for responders and civilian safety. A decontamination plan for responders and/or mass decontamination can be configured and ready to employ if necessary. As a final point, the HMRT should remain in a stand-by mode until the bomb technician has rendered the device safe.

Furthermore, a bomb technician's protective bomb suit will not protect him/her from inhalation or skin absorption exposures (Verrico, 2010). If a bomb technician were to disrupt a package that presents an inhalation or skin absorption hazard, the HMRT can immediately decontaminate the bomb technician, another rationale for the HMRT to complement the EOD Team.

HMRTs and EOD Teams have similar strategies but different operational tactics for returning the scene to a pre-emergency status. Both usually respond to incidents where very little credible information is available or even offered. Often they go into a situation blind (unknown origin of the hazard and no available information) and apply diagnostics to make a hazard assessment and risk evaluation. They formulate incident action plans, but each team employs the distinct operational tactics necessary for completing its mission. It is vital that subject matter experts from each respective team work together in complementary or supportive roles to create the best possibility for a successful resolution.

It is unrealistic to believe that special operations teams can be integrated department-wide and be efficient in administering unconventional response techniques. The NYPD Bomb Squad has suffered from this demise in the account taken below from *Bomb Squad A Year Inside the Nation's Most Exclusive Police Unit* (Esposito & Gerstein, 2007):

> Even inside the New York City Police Department—arguably the most sophisticated in the world—by early 2004 the commander of various special units had begun to want to incorporate a portion of the Bomb Squad's mission into their units. They did not understand that defusing bombs was not a part-time job. It required an ethos of doing one thing, constantly and quietly and well. One commander wanted to consider using plastic explosives to blow doors off of hinges, without necessarily being aware of the refinements of shaping charges, the storage of explosives, or the need to maintain skills; not to mention what would

> happen when it turned out to be wrong door, which past experience dictated would happen during a raid sooner or later. Another police boss wanted to build a unit of "explosives mitigation experts." This unit would take untried and uneducated detectives and supervisors and plunge them into the arcane world of tracking the transfer of bomb-making skills, the building of bombs, the ease with which terrorists could acquire the needed materials in hardware stores, and what equipment a Bomb Squad ought to consider using. This quixotic unit would a year later so embarrass the Police Department by its inept interaction with British bomb technicians that in 2006 the damage had still not been undone. In observing bomb technicians at work, well-meaning officials became confused about the skills behind what appeared to be done with such ease. (Esposito & Gerstein, 2007, pp. 59–60)

Any special operations team can be substituted for the NYPD Bomb Squad in the situation above and yield duplicate results. When technical equipment and complex resources are exploited, their capacity for effectiveness will be greatly diminished and might conceivably be detrimental.

Concepts that are developed or technology that is used in Special Operations Forces can be perfected and transferred to conventional forces. When this transpires, opportunities are presented for Special Operations Forces to acquisition improved equipment and resume surpassing the limitations of conventional forces (Tucker & Lamb, 2007, p. 149). Basic firefighting crews have benefited from fire service special operations teams through contributions to their arsenal. In particular, Dallas Fire-Rescue Hazardous Materials Response Team (HMRT) is no longer the initial response unit for carbon monoxide (CO) incidents. Single (CO) gas detectors are carried on all DFR fire apparatus for determining carbon monoxide levels and the HMRT is special called if needed. Additionally, low-and high-pressure air bags used for lifting heavy objects in technical rescue situations are carried on DFR Urban Search & Rescue (US&R) Team. Low-pressure air bags have been deemed appropriate for conventional use and all DFR truck companies carry them as part of their equipment inventory.

C. IS THE FRAMEWORK FOR DALLAS FIRE-RESCUE TEAMS FLEXIBLE ENOUGH FOR MANY FIRE DEPARTMENTS TO UTILIZE WHEN ESTABLISHING OR MAINTAINING SPECIAL OPERATIONS TEAMS?

The importance of developing special operations teams' subject matter experts (SME) has been critically examined and analyzed in this research. A principal finding is that no single person can be an SME in multiple disciplines, nor can one special operations team carry the amount and variety of required equipment caches. The cost of special operations teams will be crucial to decision makers and the epitome of the lessons learned from the NYPD in integrating bomb technicians department-wide proved to be less than mediocre and completely unacceptable.

During difficult economic times when fire service budgets are laboriously scrutinized, fire service special operations teams become a "precarious value." Consistent with precarious values as defined in *Unconventional Warfare: Rebuilding U.S. Special Operations Forces* (Marquis, 1997):

> As described by Philip Selznick in *Leadership in Administration*, precarious values are those goals or missions within an organization that are in conflict with, or in danger of being overwhelmed by, the primary goals or missions of the organization. Precarious values may be at risk because they are in conflict with the primary organizational culture, or sense of mission, of the institution. (Marquis, 1997)

In the case of Dallas Fire-Rescue, there is no doubt that the sense of the mission has changed and the abounding need for cultural reform is evident. In December 2009, *The Dallas Morning News* reported the city of Dallas, Texas, was officially declared as one of the nation's top 10 targets for terrorism by the Department of Homeland Security (Gillman, 2009). This designation was approved at the urging of formal pleas by city government officials to the DHS Secretary (Gillman, 2009). Compensation to the Dallas area for a top 10 moniker was approximately $25 million dollars under the 2010 Urban Area Security Initiative (UASI) for strengthening homeland security (Gillman, 2009).

The framework of Dallas Fire-Rescue Special Operations Teams that has been laid out in each chapter has positive aspects as well as inadequacies. The inadequacies of all DFR special operations teams revolve around staffing each team appropriately with subject matter experts to maintain optimum operational performance and efficiency. The recommendations for these inadequacies will be presented in Chapter VII. The positive aspects for establishing and maintaining special operations teams are charted in Table 28:

Table 28. Positive Aspects of Dallas Fire-Rescue Operations Teams

Positive Aspects of Dallas Fire-Rescue Special Operations Teams
Selection for Special Operations Teams are made from volunteers only
Adhering to national recognized standards when training personnel
All Special Operations Teams are capable of fulfilling city and regional responses
Vigilance of Special Operations Teams to mitigate complex technical events that exceed the guidelines of standard operating procedures
Dual roles (firefighting and search & rescue) can be considerably cost effective as seen in the Urban Search & Rescue Team
Requiring on-duty continuing education (C.E.) decreases overtime pay and affirms all members are getting the same information
Staff Special Operations Teams appropriately following national standards or the best policy is to mirror the national standards when no specific directive has been set
Special Operations Teams complementing and/or supporting other Special Operations Teams
Special Operations Teams advancing conventional firefighting forces by transferring concepts and technology they have perfected and no longer need for unconventional use
The value each Special Operations Team offers in minimizing complex challenges of homeland security and defense

As described in the municipal management series *Managing Fire and Rescue Services* (Compton, 2002):

> When local government funds the fire department and its career fire protection personnel, one can expect the range of departmental services to blend the reactive with the more proactive. Proactive fire department services, besides increasing the value of budgetary expenditures for the department, benefit the community by improving public safety. And as the fire department assumes a role in improving the quality of life in the community, the department gains public support. (Compton, 2002, p. 128)

It is incumbent on fire service executive administrations to carefully consider special operations teams as a proactive stance in moving the fire service away from the status quo of basic fire protection and commit to establishing homeland security preparedness and response capabilities to local communities.

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VII. CHALLENGING TRADITION—THE VALUE INNOVATION OF RANK-SPECIFIC ORGANIZATIONAL REFORM

Previous chapters of this thesis demonstrate that the requirements and expectations for special operations teams are set at a higher level than for conventional firefighters. Special operations teams are special and comprised of an elite group of firefighters. As described by the author Norman, some firefighters entertain the idea of becoming a special operations team member through misplaced perceptions of glamour and increased monetary benefits (2009). All firefighters are not qualified for enlistment into special operations teams, and some are unaware of the required personal commitment—which is unyielding and unforgiving. Deputy Chief Ray Downey of the New York City Fire Department (FDNY) used to call this type of person a "front-piece collector" because they "are only interested in the perceived benefits of working in the special unit; going to a lot of fires and interesting assignments, perhaps specialization pay, and reduced administrative duties" (Norman, 2009, p. 24).

Chief Downey knew best what kind of person that it took to be a special operations team member because he was a pioneer in the technical rescue field during his forty-year career with FDNY (Norman, 2009). He was a major force in creating Federal Emergency Management Agency (FEMA) urban search & rescue (US&R) teams, and was a FEMA Response Operations Chief, deploying to all types of disasters when called (Norman, 2009). On the fateful day of September 11, 2001, Chief Downey was the chief in charge of Special Operations Command (SOC) commanding special operations units and assisting in the rescue of victims in the North Tower when it collapsed (Norman, 2009, p. ix), ending the life but not the legacy of a force multiplier for unconventional change in the fire service.

It is the goal of this research to thoroughly identify and analyze the factors that will contribute to the continued and sustained professional development of the fire service in an era of dynamic threats. This document is an instrument that can be utilized as a force multiplier, driving forward with innovative changes, guiding the fire service,

and acclimatizing the culture to the challenging times in which we live. I concur with Luntz' statement, "terrorism has no boundaries, and neither should efforts to prevent it" (Luntz, 2004, p. 1).

A. VALUE INNOVATION FOR DFR HAZARDOUS MATERIALS RESPONSE TEAM (HMRT)

The vision for the HMRT is creating a dedicated full-time hazardous materials response team staffed with subject matter experts (SME) through rank-specific organizational reform. The value innovation of this reorganization will save lives and property while reducing recovery costs.

Why is creating a dedicated full-time HMRT important to the city of Dallas? The criticality of a dedicated team lies in the city of Dallas' ability to remain a Municipal Separate Storm Sewer System (MS4) permit holder. Storm Water Management is the department responsible for enforcing and adhering to the requirements for the Texas Pollution Discharge Elimination System (TPDES) Municipal Separate Storm Sewer System (MS4) Permit Number WQ0004396000, issued to the city of Dallas by the Texas Commission on Environmental Quality (TCEQ) (City of Dallas, 2007–2008). DFR Hazardous Materials Response Team is the special operations team that provides the spill response program, required by the state for the city of Dallas to hold a MS4 permit (City of Dallas, 2007–2008). Basically, the HMRT keeps Storm Water Management and the city of Dallas in compliance with the MS4 permit requirements as stated in *The City of Dallas Annual Report Texas Pollutant Discharge Elimination System* (TPDES) (City of Dallas, 2007–2008):

> Continue and improve as necessary existing programs which prevent, contain, and respond to spills that may discharge into the MS4. The spill response programs may include a combination of spill response actions by the permittee (and/or another public or private entity), and legal requirements for private entities within the jurisdiction of the permittee [Part III.B.7 of TPDES Permit No. WQ0004396000]. (City of Dallas, 2007–2008, p. 48)

City of Dallas Storm Water Management is a vital stakeholder in the mission of the HMRT because of the reimbursement funding it provides Dallas Fire-Rescue for the

HMRT services. Storm Water Management reimburses DFR for the HMRTs Medical Surveillance Program, a hazmat coordinator, advanced training, equipment, tools, and for the incidents abated by the HMRT.

When the HMRT responds to an incident, they not only mitigate the incident but are instrumental in gathering the information necessary to bill the responsible party for the environmental remediation or hazardous spill clean-up. According to DFR Financial Services data explained in an e-mail, for fiscal year 09–10, $300,942.00 was billed-out for reimbursement with $252,389.00 actually being collected; an 84 percent successful remediation reimbursement rate that the HMRT was responsible in recovering for the city of Dallas.

Collecting 84 percent of remediation is a remarkable return for the invoices that were billed out to the party responsible for the hazardous spill. In essence, the HMRT is generating revenue that could be returned to supplement the funding for the HMRT rather than being deposited into the city's general fund. With an experienced, dedicated full-time HMRT the possibility exists to increase the 84 percent collection rate closer to a 100 percent. Why? Dedicated full-time subject matter experts will spawn the common core elements of capabilities and results (Covey & Merrill, 2006) by inspiring creative thinking and innovation within the HMRT. The hazardous materials technicians (HMT) will become more engaged in cross-functional relationships while feeling an individual (self-imposed) responsibility to the other members of the team as well as the organization (Covey & Merrill, 2006). In addition, the morale of the HMRT will be boosted.

Rank-specific organizational reform is the key to developing subject matter experts coupled with the department recovering the total value of the training cost for a special operations team member. For example, using Table 2 located in Chapter II, the cost for DFR to train one hazardous materials technician is $8,590.50, which will be rounded to $8,600.00 for this demonstration. The cost value for the department can be satisfied by retaining a HMT within the Hazardous Materials Response Team for eight years. See Table 29. Experiences and advanced training during the eight-year time-frame will develop subject matter experts necessary for staffing a hazardous materials response team.

Table 29. Cost Value to DFR for Retaining Hazardous Materials Technicians on the Hazardous Materials Response Team

Cost Value to DFR for Retaining Hazardous Materials Technicians on the HMRT	
Year	DFR Cost Value
1	$8,600.00
2	$4,300.00
3	$2,867.00
4	$2,150.00
5	$1,720.00
6	$1,433.00
7	$1,229.00
8	$1,075.00

The general problem with maintaining a hazardous materials technician in the Hazardous Materials Response Team is rank-specific staffing structure due to promotions. A hazardous materials technician should not be penalized for career progression. This problem can be alleviated by allowing a hazardous materials technician to stay on the team when he/she promotes. The goal is to develop subject matter experts while the department recovers an educational cost value by keeping experts in place. The return on investment is considerable in terms of maintaining expertise; developing senior level experience; and the collateral benefits of continual mentoring within the team. In a sense, the value of retaining subject matter experts on special operations teams can be considered priceless to the department and community during complex, chaotic events that no one else can handle.

For this example, assume four hazardous materials technicians promote out of the HMRT. The cost to replace four hazardous materials technicians is $34,400.00 ($8,600.00 x 4). However, if these four hazardous materials technicians only served four years on the HMRT, the department's loss is $17,200.00 for removing all four HMTs

prior to serving eight years, plus the cost to train four more HMTs. The cost to keep the HMT within the team after promoting can be figured by using the current pay schedule, City of Dallas Uniform Fire Salary Schedule effective October 1, 2010. In conforming to the pay schedules the high estimated average for a promotion is approximately $250.00 monthly or $3,000.00 annually (City of Dallas, 2010).

Next, to keep a hazardous materials technician in the HMRT one must understand borrowed positions. This is simple because each fire apparatus is assigned one officer, one driver engineer, and three firefighters. Borrow the promoted position, in this case using a driver engineer position, for the HMRT and pay temporary assignment pay (TAP) for the vacated driver position on the fire apparatus. Temporary assignment pay is the pay differential for a lower ranking member to staff a higher ranking position. The average cost for temporary assignment pay can be estimated at $10.00 per shift for approximately 100 shifts. The logic for using 100 shifts is that there are approximately 121–122 shifts in a calendar year and due to a member's accrued scheduled leave days (vacation, holidays, Kelly, attendance incentive), they will receive an estimated 20–22 shifts a year off. Temporary assignment pay would have been paid during the 20–22 shifts anyway, but not the 100 shifts that is reasonable to use for this illustration. Temporary assignment pay for 100 shifts is $1,000.00 ($10.00 x 100). See Tables 30 and 31 for comparison.

Table 30. Annual cost to DFR (Promotion Pay and TAP) to Retain One Promoted Hazardous Materials Technician within the Hazardous Materials Response Team

Annual cost to DFR (Promotion Pay and TAP) to Retain One Promoted Hazardous Materials Technician within the HMRT	
Annual cost of promotion pay for one Hazardous Materials Technician to remain on the HMRT	$3,000.00
Annual cost of Temporary Assignment Pay (TAP) for borrowed position	$1,000.00
Total Annual Cost (Promotion Pay and TAP) to retain one Hazardous Materials Technician on the HMRT	$4,000.00

Annual cost to DFR (Promotion Pay and TAP) to Retain One Promoted Hazardous Materials Technician within the HMRT
Total annual cost to retain one Hazardous Materials Response Technician on the HMRT to satisfy the remaining four years of the eight-year commitment is $16,000.00 ($4,000.00 x 4).

Table 31. Cost to Retain Four Promoted Hazardous Materials Technicians vs. Cost to Train Four New Hazardous Materials Technicians

Cost to Retain Four Promoted HMTs vs. Cost to Train Four New HMTs (Based on a HMTs initial eight-year commitment to the HMRT once they are assigned)	
Cost to retain four promoted HMTs for the remaining four years of their eight-year commitment [from table 29 ($16,000 x 4)] $64,000.00	Cost to train four new HMTs to replace the four that promoted out of the team ($8,600.00 x 4) $34,400.00
	Cost value of four HMTs lost due to promotion and removal from the HMRT serving only four years of an eight-year commitment [cost of years 5–8 from table 28] $17,200.00
	Total cost to DFR for removing four HMTs and training four new HMTs ($34,400.00 + $21,828.00) $51,600.00
$12,400.00 is the cost to DFR for retaining four HMTs and developing Subject Matter Experts (SME) for the remaining four years of the eight-year commitment ($64,000.00–$51,600.00). The cost to DFR per subject matter expert (SME) is only **$3,100.00** per Hazardous Materials Response Technician.	

Based on this eight-year commitment plan, the cost of $3,100.00 is a small price to pay for developing and maintaining each subject matter expert within the HMRT in a fire department that has an operating budget just north of $200 million, according to the

annual adopted budget for the city of Dallas 2009–2010 (City of Dallas, 2006). There is no additional cost in developing subject matter experts within the HMRT when the hazardous materials technician does not promote.

The current DFR policy only requires a 30-month commitment once a hazardous materials technician is assigned to the HMRT. In this case, DFR is losing $5,913.00 for every hazardous materials technician that leaves the team after the 30-month commitment is satisfied, plus the $8,600.00 cost incurred to train a replacement hazardous materials technician. The current DFR plan is not cost effective by any measure and poses no opportunity for developing subject matter experts. The department is unable to recover the total value of the cost for training the hazardous materials technician in the 30-month time-frame just when they are beginning the intermediate stage of becoming a subject matter expert.

B. VALUE INNOVATION FOR DFR URBAN SEARCH & RESCUE TEAM (US&R)

The value innovation for firefighters serving in the capacity of basic firefighters and technical rescuers is advancing members' effectiveness and efficiency by strengthening their knowledge, skills, and abilities in fire and non-fire suppression incidents. Having the experience of performing search and rescue operations during structure fires bleeds over into technical rescue tactics. Rescuers must locate their victim before the rescue can be executed then depending on the situation, extent of the circumstances, and juncture for critical decision making, decide how to consummate the rescue. As stated by Norman, "Firefighters can do it both ways" fire or no fire (2009, p. 4). It is also cost effective for the department when firefighters can serve dual function roles and use their advanced training and capabilities during any incident for which they are dispatched.

Rank-specific organization reform in the DFR Urban Search & Rescue Team can be explained using the same eight-year format in the previous example for the Hazardous

Materials Response Team. The cost to DFR for training one Urban Search & Rescue member is found in Chapter III, Table 13 and will be rounded to $26,000.00 for this illustration. See Table 32.

Table 32. Cost Value to DFR for retaining Urban Search & Rescue Members on the Urban Search & Rescue Team

Cost Value to DFR for retaining Urban Search & Rescue Members on the US&R Team	
Year	DFR Cost Value
1	$26,000.00
2	$13,000.00
3	$8,667.00
4	$6,500.00
5	$5,200.00
6	$4,333.00
7	$3,714.00
8	$3,250.00

Acknowledging the rank-specific staffing structure of DFR, the importance of developing subject matter experts within the US&R Team, even if the member makes promotion and the department attaining a cost value will be examined in the following demonstration. For this example, assume four US&R Team members promote out of the US&R Team after serving only four years. The cost to replace four US&R members is $104,000.00 ($26,000.00 x 4). The immediate loss to the department because four members left the team after serving only four years of an eight-year commitment is $52,000.00 ($13,000.00 x 4). A crux to be made here about training US&R members is the timeframe for training personnel in all five technical disciplines may take up to two years due to class availability and department scheduling issues.

Following the current City of Dallas Uniform Fire Salary Schedule and the previous explanation of a borrowed fire driver engineer position, figuring temporary assignment pay (TAP), the annual cost to retain one promoted US&R Team member within the US&R Team is calculated in Table 33. The cost comparison for retaining subject matter experts versus training four new US&R members is presented in Table 34.

Table 33. Annual Cost to DFR (Promotion Pay and TAP) to Retain One Promoted Urban Search & Rescue Member within the Urban Search & Rescue Team

Annual Cost to DFR (Promotion Pay and TAP) to Retain One Promoted US&R Member within the US&R Team	
Annual cost of promotion pay for one US&R member to remain on the US&R Team	$3,000.00
Annual cost of Temporary Assignment Pay (TAP) for borrowed position	$1,000.00
Total Annual Cost (Promotion Pay and TAP) to retain one US&R Member on the US&R Team	$4,000.00
Total annual cost to retain one US&R member on the US&R Team to satisfy the remaining four years of the eight-year commitment is $16,000.00 ($4,000.00 x 4)	

Table 34. Cost to Retain Four Promoted Urban Search & Rescue Members vs. Cost to Train Four New Urban Search & Rescue Members

Cost to Retain Four Promoted US&R Members vs. Cost to Train Four New US&R Members (Based on a US&R Member's initial eight-year commitment to the US&R Team once they are assigned)	
Cost to retain four promoted US&R members for the remaining four years of their eight-year commitment [from table 32 ($16,000 x 4)]	Cost to train four new US&R members to replace the four that promoted out of the team ($26,000.00 x 4)
$64,000.00	$104,000.00

Cost to Retain Four Promoted US&R Members vs. Cost to Train Four New US&R Members (Based on a US&R Member's initial eight-year commitment to the US&R Team once they are assigned)	
	Cost value of four US&R members lost due to promotion and removal from the US&R Team serving only four years of an eight-year commitment [cost of years 5–8 from table 31] $52,000.00
	Total cost to DFR for removing four US&R members and training four new US&R members ($104,000.00 + $52,000.00) $156,000.00
It is extremely cost effective for DFR to retain the four US&R members and develop Subject Matter Experts (SME) for the remaining four years of the eight-year commitment because the initial cost to train four new US&R members exceeds the cost to retain the members by $40,000.00. There is no extra cost to the department for retaining promoted US&R subject matter experts.	

Based on this eight-year commitment plan, there is no additional cost to the department for developing subject matter experts within the US&R Team. The current DFR policy requires a five-year commitment once a US&R Team member is assigned to the US&R Team. The department is losing $9,750.00 for each US&R member that is removed from the US&R Team after only five years of service, plus, the $26,000.00 incurred cost to train a new US&R member.

C. VALUE INNOVATION FOR DFR EXPLOSIVE ORDNANCE DISPOSAL (EOD) TEAM

The vision for the EOD Team is creating a dedicated full-time EOD Team staffed with subject matter experts (SME) by abolishing the current mandatory officer rank requirement. The value innovation of this reorganization will save lives and property while reducing high-profile on-scene time.

Analysis indicates that the case for restructuring and creating a dedicated full-time EOD Team is a result of an untenable vision and insufficient plan. The current plan Dallas Fire-Rescue has developed for the EOD Team (arson investigator/bomb technician) is unattainable for developing subject matter experts in either field. Merging career paths of fire arson investigators, police officers, bomb technicians, and hazardous materials technicians creates an exorbitant amount of mandatory continuing education hours annually that is impossible to achieve on a 24/72 schedule (24 hours on-duty and 72 hours off-duty) as validated in Chapter V of this thesis. (Hazardous materials technician is included above because it is a required prerequisite for bomb technician training and the annual mandatory continuing education hours must be included).

According to a DFR *2009 Departmental Memorandum # 80*, dated October 15, 2009, the only members eligible to apply for the DFR Explosive Ordnance Disposal Team are candidates from the fire prevention series and individuals that currently hold the rank of lieutenant, captain, or section chief. This directly excludes Emergency Operations Bureau firefighters, as well as any ex-military trained EOD personnel serving as firefighters on the department.

The bomb squad transition plan DFR blueprinted in *2009 Departmental Memorandum #34* (described in Chapter IV) can be revolutionized immediately and all further expenses amended through a complete metamorphosis. The plan prescribed below is more suitable for the department budget-wise in recovering the cost value of training the cardinal amount of bomb technicians and developing career subject matter experts.

Plan for Reorganizing DFR Explosive Ordnance Disposal Team includes:

- Dedicated full-time EOD Team that functions as bomb technicians only.
- Bomb technicians' annual mandatory continuing education hours decrease to a more manageable 242 hours.
- Maintain a 40-hour work week and schedule duty rosters for EOD response afterhours, weekends, and holidays.
- Staff the team with six to seven certified bomb technicians (this allows for constantly mentoring approximately two bomb technicians).

- Abolish any rank-specific requirement for the EOD Team and move to select volunteers with experience or the knowledge, skills, and abilities for excelling as a bomb technician.
- Assign two arson investigators as the primary case investigators for assisting the EOD Team on explosive/bomb incidents.
- The Senior Bomb Technician is the commander on all EOD incidents.
- Automatically dispatch DFR Hazardous Materials Team with all EOD responses for complement/support.
- Automatically dispatch a medical surveillance team (A Rescue staffed with two paramedics) to stand-by for medical assistance while the bomb technician is in the hot zone.
- Automatically dispatch Dallas Police SWAT team to complement/support the EOD Team on predefined incidents
- Transfer the EOD Team to the Emergency Response Bureau
- Relocate the EOD Team, emergency response apparatus and equipment to a secure location (i.e., fire station).
- Require a minimum eight-year initial commitment when bomb technicians are assigned to the EOD Team

The EOD Team reorganizational plan above expunges the rank-specific requirement along with all efforts to combine exorbitant career paths, and reduces the overall number of bomb technicians for developing and retaining subject matter experts. The cost value for retaining bomb technicians within the EOD Team for eight-year commitment is listed in Table 35.

Table 35. Cost Value to DFR for Retaining Bomb Technicians on the Explosive Ordnance Disposal Team as Bomb Technicians Only

Cost Value to DFR for Retaining Bomb Technicians on the Explosive Ordnance Disposal Team as Bomb Technicians Only	
Year	DFR Cost Value
1	$10,600.00
2	$5,300.00
3	$3,533.00

Cost Value to DFR for Retaining Bomb Technicians on the Explosive Ordnance Disposal Team as Bomb Technicians Only	
4	$2,650.00
5	$2,120.00
6	$1,767.00
7	$1,514.00
8	$1,325.00

As illustrated in Chapter IV, the current DFR Explosive Ordnance Disposal Team is staffed with four Dallas police officers who have been transferred to the fire department. In essence DFR added four full-time employees (FTE) to their staffing chart. This is the opportune time to make the conversion to the new proposed plan and budget for the additional two to three bomb technicians. The passage taken below from *Bomb Squad A Year Inside the Nation's Most Exclusive Police Unit* characterizes, as well as justifies, the importance of subject matter experts performing the "rank-less" duties of a bomb technician (Esposito & Gerstein, 2007).

> In their way of thinking they are last responders—the last line of defense before an explosion occurs and the ambulance teams, doctors, aid workers, and morgue attendants have to be brought in. Their mission requires them to confront an unknown and lethal enemy.
>
> Think of it this way:
>
> When an X-ray technician takes a picture and a doctor interprets it, they are studying a light-and dark-gray transparency in a climate-controlled room. It is a picture of a part of the human body each has seen thousands of times before. When a bomb technician takes a picture of a bomb, he is taking it lying on his stomach in the middle of a street and peering through his own sweat. When he gets up to his knees, stands, and then waddles back to his partner to interpret it, what they study is an image of something that neither of them has seen before. The bomb tech faces a unique challenge; his interpretation of the gray tones of an X-ray is the first interpretation of them.

> This is the key reason why rank carries very little weight in the field. The technician's life depends on the technician's interpretation. Nothing more and nothing less. (Esposito & Gerstein, 2007, p. 11)

Rank-specific organizational reform will certainly challenge the long-held traditions of Dallas Fire-Rescue and the development of special operations teams that are necessary for completing extraordinary missions, utilizing unconventional methods. For those that continue to resist change and refuse to accept the mission of the fire service has changed, this author's message is:

> We cannot expect to change our long-held traditions, to reorganize our army and to create great cities without internal opposition. Among you chieftains and Huns will be those whose spirits cling to our past ways. We will show patience with you unenlightened ones. Yet, if you choose not our new course and cause dissention, you will be stricken from our ranks. (Roberts, 1985, p. 94)

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