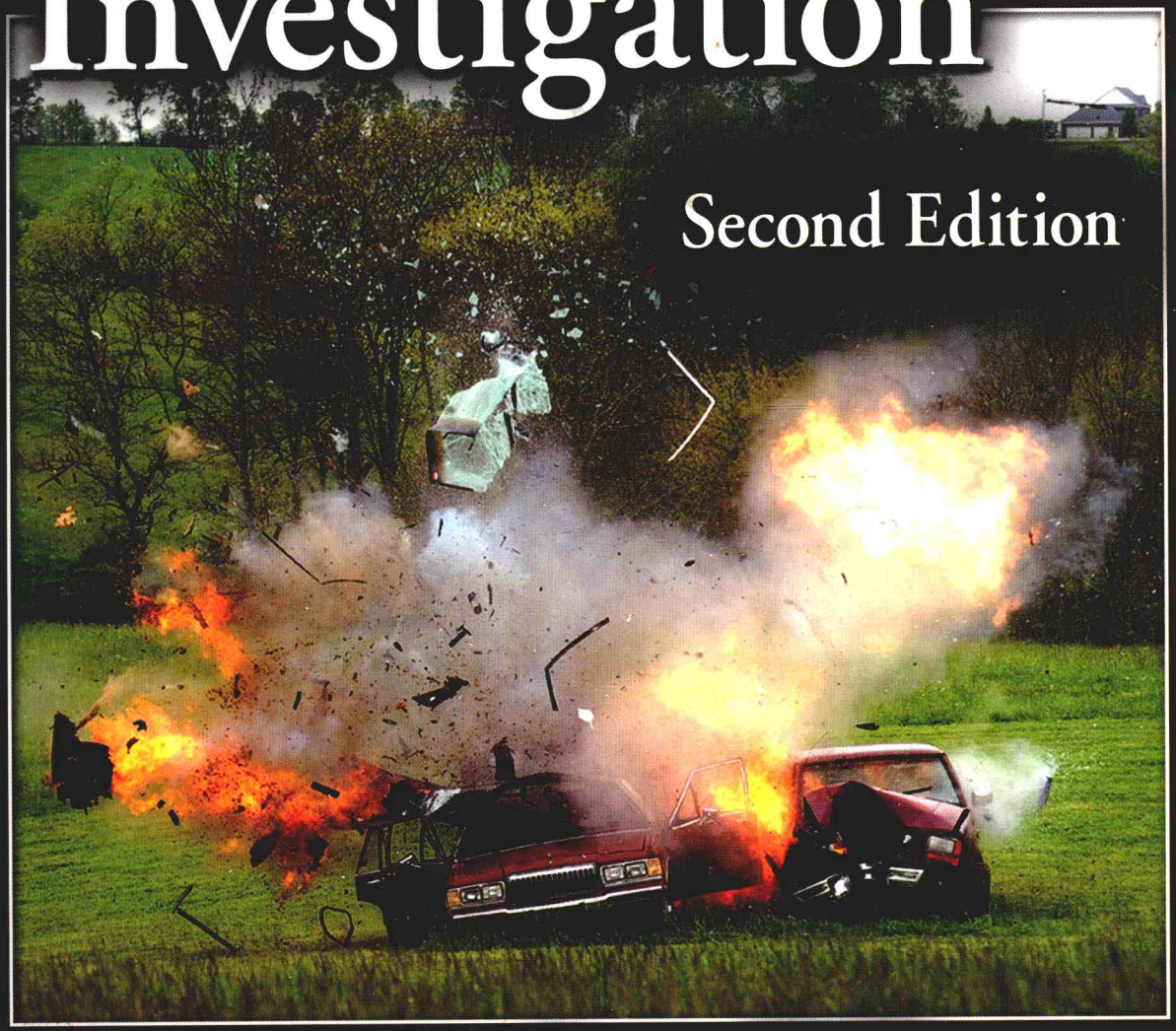
Practical Bomb Scene Investigation

Second Edition



James T. Thurman

Practical Aspects of Criminal and Forensic Investigations Series

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Practical Bomb Scene Investigation

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This book is dedicated to the post-blast investigator and the bomb technician, for all that you do and the sacrifices you make, and to my family, Lorenda, Chris, Margaret, Libby, Mom, and Dad, to whom I express my heartfelt thanks for your continuing love and support.

Series Note

This textbook is part of a series titled *Practical Aspects of Criminal and Forensic Investigation*. This series was created by Vernon J. Geberth, New York City Police Department lieutenant commander (retired), who is an author, educator, and consultant on homicide and forensic investigations. This series has been designed to provide contemporary, comprehensive, and pragmatic information to the practitioner involved in criminal and forensic investigations by authors who are nationally recognized experts in their respective fields.

Foreword

I am delighted that Tom Thurman has authored *Practical Bomb Scene Investigation*, which will certainly become the bible for explosive forensic experts, improvised explosive device (IED) specialists, and military and civilian academics who teach this most critical discipline. Just as importantly, Tom Thurman's long and celebrated career as one of the top FBI agent experts in the area of post-blast forensics provides his readers with unique insights and analytical skills that only a superb investigator like Tom can integrate into this science. The treatise's skillful use of real case studies and the impact that IED forensic analysis has on criminal investigations, and the ultimate success of later prosecutions makes *Practical Bomb Scene Investigation* a "must-read" not only for forensic experts, but just as importantly for prosecutors, lawyers, and judges. Tom Thurman has taken his extraordinary and rich 30 years of public service to the FBI and our Nation, and translated his immense experience and special knowledge into *Practical Bomb Scene Investigation,* a permanent gift to the law enforcement community and to our public safety.

I had the personal privilege of serving with Tom Thurman for over 8 years (1992–2001) in the FBI. Even in those years prior to the attacks of September 11, the FBI became totally immersed in a series of devastating and escalating terrorist attacks, which utilized IEDs to attack both "soft" civilian as well as "hard" military targets. These attacks were launched against the United States both domestically (UNABOM, Oklahoma Federal Building, World Trade Center [1993]; Atlanta Olympics, Moody's VANPAC) and overseas (Pan Am 103, Khobar Towers, East Africa U.S. embassies, USS *Cole*), which resulted in the FBI devoting huge resources to combat this terrorism and directly led to the establishment of its first Counterterrorism Division in 1999. Thanks to the work of literally thousands of dedicated FBI men and women, who worked tirelessly and at great personal risk in many cases, every one of these complex and devastating cases was solved by the FBI and subjects were arrested, indicted, convicted or remain fugitives. Essential to the success of all these major cases, which had huge public safety, political, military, and foreign policy consequences, were the FBI agents and scientists like Tom Thurman and his incredibly talented, committed, and brilliant colleagues in the Bomb Unit, who were at the very "cutting edge" of the FBI's success. Without their magnificent and sometimes unsung work, sifting through desert sands in 115°F temperatures retrieving post-blast debris from smoldering ruins, underwater and in the most dangerous of neighborhoods, none of these cases could have been made. *Practical Bomb Scene Investigation* takes its readers through the highly stressful and pressurized investigative process where the IED expert's work and conclusions drive and channel the entire criminal investigation to the right and fair conclusions. Only a seasoned and talented writer–scientist like Tom Thurman can take the reader on this unique journey, showing him or her the best pathways, avoiding the easy professional pitfalls, and how to do a tremendously critical job with intelligence and integrity.

The highest quality and professional post-blast science and experience imparted by Tom Thurman in *Practical Bomb Scene Investigation* is greatly needed and should be valued by everyone committed to fair process and the Rule of Law. All too frequently, shoddy

or intentionally bad IED forensic work can lead to unfair results and the miscarriage of justice. Moreover, honest mistakes by forensic investigators lacking Tom Thurman's skills can derail the entire criminal justice process, harming innocent people, and shielding the guilty. For example, when *TWA 800* exploded shortly after taking off from the John F Kennedy International Airport, there was a valid working assumption that the 747 aircraft, which had a sound safety record, was taken down by an IED somehow taken onboard. Indeed, during the meticulous FBI post-blast investigation (where over 90% of the aircraft was recovered from the Atlantic Ocean and reassembled in a Long Island plane hangar), high explosive residue was detected by Tom Thurman's unit in one of the plane's reconstructed overhead compartments. However, rather than concluding (perhaps justifiably) that an IED was the cause of the tragedy, Tom's unit recommended a more thorough investigation before concluding that an IED was involved. Their expert opinion here was critical and based on experiences as trained FBI investigators rather than simply explosives experts. Thanks to their caution and wise counsel, further investigation disclosed that the aircraft had previously been used in an IED training exercise, and hence the explosive residue finding. The FBI later concluded that faulty wiring in the fuel tank had caused the devastating explosion and tragic loss of life.

We all owe Tom Thurman a debt of gratitude for giving us *Practical Bomb Scene Investigation*, which I highly recommend to all law enforcement professionals, lawyers, and Americans concerned about our nation's safety, and also for the outstanding contributions made to us by FBI agents like Tom Thurman and his wonderful colleagues, past, present, and in the years to come.

Louie Freeh
Director, FBI
1993–2001

Acknowledgments

As I previously stated in the first edition, words alone cannot adequately express my sincere gratitude to my colleagues for the invaluable assistance they provided in the preparation of this book. Actually, this assistance began many years ago during my preparation for a career as a bomb disposal technician and, ultimately, as a hazardous-devices examiner and post-blast investigator. Sergeant First Class John Flynn and Master Sergeant John Summers, now deceased, taught me how to be an effective bomb technician. Thank you for your patience and for sharing your knowledge. I express my thanks to Fred Smith, now retired unit chief of the explosives unit, FBI Laboratory, for believing in me and helping me to make the move from the Army to the FBI, and to Stuart Case, also of the explosives unit in which he too worked as a unit chief, for bringing me to the FBI Laboratory and providing me with the opportunities of a hundred ordinary lifetimes. I sincerely hope you will accept this book as a partial payment for all you have taught me about being a post-blast investigator. One should only take for so long before giving something back to the program from which one came. Also, I express my thanks to my colleagues and my friends in the laboratory, Denny Kline and Chris Ronay, for guiding me through the intricate processes of IED component examination and identification. May the wind be always at your back.

To Danny Defenbaugh, I express my sincere appreciation for taking me into the depths of the bomb craters and explaining the fine art and science of bomb scene investigation and reconstruction. Wally Higgins, Tom Mohnal, Rick Hahn, Dave Williams, Paul Schrecker, and Al Jordan, I want you to know your support and friendship are valued. Also, I express my sincere regard to Nick, Greg (now unit chief of the explosives unit), and Mike for putting up with me in the unit. I owe so much to these true professionals.

To my coconspirators at the Eastern Kentucky University, Bill Abney and Ron Hopkins, both now retired, and Bill Hicks, I express my thanks for accepting me into the fire brotherhood and helping me adjust to academia and the classroom. Your perspective regarding the investigative process is evident throughout this book. Without your encouragement, this book would not have been possible.

I will forever be indebted to the following individuals who took their valuable time to review the manuscript and offer advice and recommendations for improvements:

Jeff Norwitz, former professor at the Naval War College and retired Naval Investigative Service special agent, for your encouragement and suggestions.

Paul Cooper, retired explosives engineer at the Sandia National Laboratory and consultant, for your review and contributions of the material contained in Chapters 1 and 4, especially regarding the Oklahoma City bombing investigation and what data to collect at the scene in order to provide an estimate of the quantity of explosives used in a bombing. As was your father, you are a great engineer.

Bob Hopler, retired explosives technical manager for the Hercules Powder Company (Wilmington, Delaware), Ireco, and Dyno Nobel, and the foremost authority on the history of the U.S. explosives manufacturing industry, provided the technical accuracy regarding

the identification of explosives and their historical development. Yes, I did appreciate all your corrections and additions.

Retired FBI Special Agent David Heaven and Supervisory Special Agent David Jernigan, Bomb Data Center Hazardous Devices School program manager, for your review and suggestions regarding what should and should not be published about IED componentry in Chapter 3.

I express my gratitude to the FBI Laboratory forensic chemist Ron Kelly and retired FBI Special Agent Frank Doyle, formerly of the San Francisco Division, the FBI evidence response team coordinator and FBI bomb technician, for their many hours of review of post-blast investigation procedures. Your recommendations and corrections were on target and much appreciated; also, Ron, for your corrections and for keeping me on track regarding the capabilities of the laboratory.

I also want to provide my sincere appreciation to FBI Supervisory Special Agent Bomb Technician Christopher Rigopoulos (Rigo) of the explosives unit and Bob Heckman, retired FBI supervisory special agent bomb technician, also of the explosives unit, for providing me with the information contained in Chapter 8. Rigo, I am especially grateful for the time you spent with me going over the finite details of tactical response to post-blast scenes and sharing your experiences. As a result of your experiences and the information gained from them, I know that untold numbers of post-blast investigators will not only survive the tactical challenges but also excel in their efforts when investigating such scenes.

To Colonel Bob Leiendecker, retired U.S. Army explosive ordnance disposal (EOD) officer, military historian, and technical intelligence specialist, I am indebted for not only conducting a profoundly professional review of the military ordnance chapter but also opening his home and museum to me, and for providing the names of explosives contained in Appendix B. Bob, any success of Chapter 6 in helping investigators avoid the hazards associated with unexploded military ordnance can be directly attributed to your continuing support and recommendations.

There are many additional individuals who have directly influenced the completion of this book. I express my sincere appreciation to Matt Nelson, Jason Griest, and Stephanie Slivinski, for their outstanding diagrams and photographs prepared for Chapter 4; Colonel Jack Edwards, retired U.S. Army ordnance officer and EOD technician; John Capers, Austin Powder Company; Rana Weaver, New Mexico Tech; Chris Radcliffe and Teresa Snow of the Eastern Kentucky University, for their much-needed photographs and illustrations; Dan Dougherty for his assistance in the preparation of the explosives spreadsheet; Kirk Yeager of the FBI's explosives unit for his review and information concerning improvised explosives; Lucas Tinsley for his assistance in photography and being there for me in the hot Kentucky summer; and Sabrina Paris of Pearson Education, Inc., for her permission to use the adapted Figure 1.1 (Chapter 1) from *Forensic Fire Scene Reconstruction* by David Icove and John DeHaan (New York: Pearson, 2004).

I especially want to thank my publisher at Taylor & Francis, and a very special group of professionals for seeing me through the writing of the second edition, as well as the original book. These include Becky Masterman, Jill Jurgensen, Glen Butler, and Melaine Minch for their tireless efforts in promoting my book. Further, special gratitude to Melissa Cocozziello and her staff for their exemplary editing skills within this second edition. Your tireless recommendations were always much appreciated and on the mark. Last, but absolutely not the least, I extend my warmest gratitude to the series editor, Vernon Geberth, retired lieutenant commander, New York City Police Department, and a prolific author whom I highly respect.

If I have neglected anyone, please excuse my oversight, as it was not intentional.

Introduction

As played out on the international stage, the morning news remains the same day after day: a suicide bombing here or a vehicle bombing there. Usually, this is accompanied by reports of losses of lives and of bereaved loved ones left to fend for themselves. This is the age of the bomb, not necessarily the nuclear bomb, but the IED, and transnational terrorists have already seized its utility. However, in the United States, the use of an explosive device is not necessarily related to terrorist acts, but may be used to seek revenge or just for plain mischief. However, it does not matter to those affected by IEDs whether an event is classified as a terrorist act or not. A bomb is a bomb, and the motivation behind using it comes secondary to the damage and destruction caused by it. As such, it is the responsibility of the bomb technician and the bomb scene investigator to join forces in order to protect the public and to identify and remove bomb fabricators from society.

As I was writing this paragraph 4 years ago, little did I know how true these words were going to be in the future (now the past). Bombing campaigns intensified in Iraq and then began to subside, only to increase their intensity in Afghanistan. India, Pakistan, Russia, Sri Lanka, to mention only a few, followed suit with their own paths of destruction and losses of innocent lives. In the United States also, the landscape has changed over the years. We have gone from the "shoe bomber," Richard Reid, to the "underwear bomber" who appears to have been a willing convert to radicalism. Moreover, unrestrained brutality has spread to local "homegrown" terrorists who kill our heroes on their way to make the world a little safe for all of us. There are also homegrown groups, who clandestinely organize terrorist attacks on not only our soil but also foreign lands. One may ask, what is going on? For that question, I have no answer.

It is essential for bombing investigators to be prepared to meet the challenge associated with the seemingly impossible task of locating evidence among the rubble following an explosion. Many mistakenly believe that nothing survives the explosion and little can be gained from a methodical time-consuming scene investigation. However, research has shown that more than 90%, by weight, of the components, less the explosives, actually survive the explosion. Understandably, these components will not be in their original identifiable condition. This, then, becomes one of our duties: to educate investigators to understand that valuable evidence does survive the explosion.

This book was written for the bomb scene investigator, the evidence technician, laboratory examiner, intelligence analyst, the soldier on patrol, and the public safety officer—either the policeman or firefighter—on the street. In essence, its aim is to provide in one place the methods utilized to locate and preserve evidence recovered from the post-blast scene for eventual use in a court of law. I have been inspired by the overwhelming response the first edition got the minute it was originally released in March 2005. From this, I have tried to enhance this edition with additions that will further assist a post-blast investigator. These include a better understanding of detonation pressure and its effects on the body, details on how to collect additional information from the scene in order to provide an estimate of the explosives weight of the IED, a glossary for a more in-depth understanding

of the terms associated with explosives and the investigation processes, and a greatly expanded IED component identification chapter. I have also included a chapter on how to expeditiously investigate a post-blast scene in a hostile environment. A sign of the times, I guess.

Additionally, this book endeavors to provide easy-to-understand step-by-step procedures for managing and processing a bomb scene by detailing the skills required by an investigator in finding the evidence and making sense of what is found at the scene. As such, this book is a road map of knowledge on not only how to find and collect evidence but also how to safely and effectively assess the scene.

All crime scenes have stories to tell. Understanding the language of a bomb scene is the purpose of this book. Additionally, it sets forth the methods used to determine if other types of mass-destruction materials (radiological, chemical, or biological materials) or military ordnance were used at the scene.

Although the scene investigative procedures as detailed in this book can be utilized for small to large bomb scenes, this work does not elaborate on the management procedures to be employed following a massive bombing such as that of the Alfred Murrah Federal Building, Oklahoma City, in April 19, 1995. Also, this book does not contain information on the methods of assembling an improvised device. A detailed description of the components is included, but not on how to construct a device or the improvisation of explosives used. Too much of this information is already available in the world market through the Internet and various publications. I do not intend to add to this body of fabrication data.

Bombs are the unique tool of a specific type of perpetrator, and investigation of bombings requires exceptional knowledge. The reader is encouraged to study from these pages and develop the skills necessary to solve these heinous crimes.

Tom Thurman
May 2010

Author

James T. Thurman has worked in the explosives field for more than 30 years, first as a U.S. Army bomb disposal technician and then as a special agent with the FBI. As a supervisory special agent in the FBI Laboratory, he forensically examined the exploded remains of hundreds of IEDs and traveled extensively throughout the United States and the world to collect evidence and conduct bomb scene investigations. The cases investigated by him include the bombing of the U.S. Embassy in Lebanon in 1983 and 1984; the bombing of the Marine barracks, also in Lebanon in 1983; the bombing of Pan American Flight 103 over Lockerbie, Scotland; the bombing deaths of Federal Judge Robert Vance in Alabama and attorney Robert Robinson in Georgia in 1989; and the 1993 bombing of the World Trade Center in New York. Prior to his retirement from the FBI in 1998, Thurman was the chief of the FBI Bomb Data Center, whose responsibilities included the training of all public safety bomb disposal technicians in the United States.

Thurman has lectured and continues to lecture and provide training on the methods of bomb scene investigation and explosives avoidance to domestic and international training schools and audiences. He is a member of a number of professional organizations, including the International Association of Bomb Technicians and Investigators (IABTI), as an advisor, and the International Society of Explosives Engineers (ISEE). Thurman is a Certified Fire and Explosion Investigator (CFEI) and a Certified Vehicle Fire Investigator (CVFI) under the National Association of Fire Investigators (NAFI). As a member of various national planning panels, he has participated in the preparation of the two best practice guides published by the U.S. Department of Justice: *Crime Scene Investigation: A Guide for Law Enforcement* and *A Guide for Explosion and Bombing Scene Investigation*. Additionally, he is the committee chair of the Training and Education Committee for the Technical Working Group for Fire and Explosions (TWGFEX) under the National Center for Forensic Science at the University of Central Florida.

Thurman is currently a professor at the Eastern Kentucky University, teaching a unique academic program on fire, arson, and explosion investigation. He holds a BA from Eastern Kentucky University and an MS Degree in Forensic Science from the George Washington University.

Table of Contents