

SECOND
EDITION

SHOOTING INCIDENT

RECONSTRUCTION

Michael G. Haag and Lucien C. Haag



SHOOTING INCIDENT RECONSTRUCTION

SECOND EDITION

MICHAEL G. HAAG

*Forensic Science Consultants
Albuquerque, New Mexico*

LUCIEN C. HAAG

*Forensic Science Services, Inc.
Carefree, Arizona*



ELSEVIER

AMSTERDAM • BOSTON • HEIDELBERG • LONDON
NEW YORK • OXFORD • PARIS • SAN DIEGO
SAN FRANCISCO • SINGAPORE • SYDNEY • TOKYO

Academic Press is an imprint of Elsevier



Academic Press is an imprint of Elsevier
525 B Street, Suite 1800, San Diego CA 92101, USA
The Boulevard, Langford Lane, Kidlington, Oxford, OX5 1GB, UK

First edition © 2006 Elsevier Inc.

© 2011 Elsevier Inc. All rights reserved

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publisher. Details on how to seek permission, further information about the Publisher's permissions policies and our arrangements with organizations such as the Copyright Clearance Center and the Copyright Licensing Agency, can be found at our website: www.elsevier.com/permissions

This book and the individual contributions contained in it are protected under copyright by the Publisher (other than as may be noted herein).

Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors, assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

Library of Congress Cataloging-in-Publication Data

Haag, M. G.

Shooting incident reconstruction / Michael G. Haag and Lucien C. Haag. — 2nd ed.
p. cm.

Lucien Haag is the first named author of the earlier ed.

Includes bibliographical references and index.

ISBN 978-0-12-382241-3 (alk. paper)

1. Forensic ballistics. I. Haag, Lucien C. II. Title.

HV8077.H22 2011

363.25'62—dc22

2011005208

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

For information on all Academic Press publications
visit our Web site at www.elsevierdirect.com

Printed in China

11 12 13 14 15 10 9 8 7 6 5 4 3 2 1

Working together to grow
libraries in developing countries

www.elsevier.com | www.bookaid.org | www.sabre.org

ELSEVIER

BOOK AID
International

Sabre Foundation

SHOOTING INCIDENT RECONSTRUCTION

SECOND EDITION

This second edition is dedicated to the many unsung seekers of fact (my wife, father, and many friends included) amidst the chaos that humanity brings upon itself. May we all endeavor to keep our sense of wonder and curiosity in the face of bureaucracy.

Also, to Luke and Sandi for a much-appreciated boost into a career I love, and to my wife, whose unswerving support in this wild profession has been a source of unbelievable strength.

Michael Haag

*For Sandi, Matt, and Mike for whom nearly every picnic or outing in our beautiful Arizona desert ended in gunfire.
And to the memory of Gene Wolberg.*

Lucien Haag

Introduction

As I write this second edition of *Shooting Incident Reconstruction*, I reflect on my experiences with firearms and my professional experiences with investigations of shooting incidents. I was extremely fortunate to have grown up with two fantastic parents who encouraged inquisitiveness, thoughtfulness, and a sense of excitement for the unknown. Such characteristics are common in the individuals who have inspired me personally and professionally.

Of the volumes of information I have collected from my dad, there is one quote that I commonly find comforting when dealing with lawyers, investigators, and peers. It sums up a very pure thought and intention that should be a foundational belief of anyone in this profession: "*We aren't in the happiness business.*" No matter what we find, someone will be unhappy. Unlike the many "CSI" programs that populate television these days, it is a fact of real life in forensics. One side or the other will want to find something to criticize in our work, and that is the nature of an adversarial legal system.

In the end, this is a good thing. It ensures that we are always on our toes as we attempt to improve the quality of our work. It also means that we should be open to new ideas and concepts because the way we investigate events is always changing (hopefully for the better). In an era in which ASCLD-ISO literature governing the accreditation of crime laboratories in the United States attempts to have the scientist act in a fashion that is oriented toward "customer" service, the correct forensic scientist will step back and repeat the mantra, "*I am not in the happiness business.*"

Take comfort in that, and know that while we should always keep an open mind to criticisms and new ideas, we are not driven to any conclusion to please a lawyer, police investigator, plaintiff, defendant, judge, or supervisor. Most carefully, we should guard against any belief that what we conclude is relevant to any sort of sense of *justice*. At the end of the day, we must all report only what we believe the evidence is telling us. This may mean a simple "I don't know" or "Inconclusive"; that is, the result is the best we can glean from the available information. The scientists who do their job correctly are at peace with this, knowing that we are interpreters, and a voice, for otherwise mute physical evidence. We are not avenging angels, servants of a higher power, or puppets to simply repeat or publish what an attorney or police official would like to hear.

From my earliest years, I remember seeing both the positive and the negative effects of people's use of firearms. Many of my weekends from grade school on were spent in the beautiful Arizona deserts and forests conducting experimental research or case investigations relating to firearms. These endeavors were often spawned from some horrific event created by one human being's actions toward another, but the more important aspect of these times were the life lessons I learned from my parents with regard to personal use of firearms and respect for them.

While I was becoming familiar with the reconstructive aspects of firearms and of ammunition, as well as terminal and external ballistics, I was almost subconsciously learning about the great responsibilities that should

be associated with the ownership of firearms. These lessons of conscientiousness and responsibility should be, and are, common sense to most law-abiding owners of firearms. But there is a strange dichotomy in my life in that my work and passion—shooting incident reconstruction—is fueled by the antithesis of these tenets.

The first edition of this book was written by my father as a result of a life-long interest in and enjoyment of firearms: their power, their mystique, their ability to defend a life, to save a life, and to take a life. We are both passionate about the Second Amendment—in fact, all of the amendments to the U.S. Constitution—and are always very troubled by those who would pervert it, abolish it, or deny law-abiding citizens the ability to keep and bear arms in the defense of themselves and others.

For Luke also, an interest in firearms started when he was a boy. He grew up outside of Springfield, Illinois, where he received his first BB gun, a Red Ryder 500-shot lever-action blue-steel beauty that still today resides somewhere among the many firearms he has come to own.

During his high-school years in Lynwood, California, Luke became an avid hand loader for several centerfire rifles and handguns, joined the high school rifle team, and often spent his weekends in the Mohave Desert camping and enjoying informal target shooting. It was during these outings that he came to be more and more interested in the technical and scientific aspects of firearms. He began to ponder questions such as “How far do bullets travel?” “How far do ricocheted bullets travel?” “What do such bullets look like after they have ricocheted off a variety of surfaces?” “What do a bullet and a gunshot sound like when heard from a substantial distance downrange?” “How deeply do bullets penetrate into a variety of materials?”

Following the receipt of his Bachelor of Science degree from the University of California at Berkeley, Luke took several courses in criminalistics at California State College at Long Beach, where he first became aware that firearms identification was a part of this profession. A career in criminalistics and a position in a crime laboratory would be a way to apply his training in chemistry, math, and physics to tests and experiments with firearms.

This ideal arrangement was realized when he obtained a position as a criminalist for the City of Phoenix in June of 1965. His arrival there made the Phoenix Police Crime Laboratory a two-man organization. It was a classic case of being in the right place at the right time.

During the next decade, he worked in all sections of this growing crime laboratory, including the new firearms section. Sometime during the 1970s he became the supervising criminalist of the Phoenix lab. All the while, the firearms-friendly State of Arizona provided many locations and opportunities to carry out applied research, and he began writing and publishing papers in the forensic literature.

In 1982 Luke left the Phoenix laboratory to start his own consulting company specializing in the investigation of shooting incidents. He then continued to experiment, to publish, and to give training seminars related to firearms evidence and shooting scene reconstruction. These seminars and workshops ultimately became the book *Shooting Incident Reconstruction*, first published in 2005.

The dedication in the first edition has a somewhat tongue-in-cheek apology to my mother, my older brother Matt, and me for “subjecting” us to experiments that were nearly always a part of any outing in the desert or mountains of our state. My memories of my youth often involved some sort of experimenting. Soon I was helping my

father with his experiments, and my brother and I were presented with guns of our own from our trusting parents, along with instructions in the safe and responsible handling of same, as a classic right of passage into adulthood for an American boy.

In more ways than I can count, my dad's interest in "all things firearms" wore off on me. Those many weekends in grade school spent getting up before sunrise to trek out into the fantastic Arizona desert were sometimes grueling but always rewarding. And I mean that not just in the sense of learning about my future profession but, more important, in the sense of learning about work ethic, about responsibility (in more than just the use of firearms), and about my dad. Most in "the business" know him professionally, but I consider myself beyond privileged to also know his peculiar sense of humor and about the many things that he holds as imperatively sacrosanct.

ACKNOWLEDGMENTS

I feel that I have had an almost unfair advantage in this field because of my contact with my dad. I am always touched by the fact that I can travel halfway (or all the way) around the world and find investigator after investigator who he has helped in one way or another. He is always there to lend an ear and give a helpful suggestion. Especially considering all of his accomplishments, and the positive effect he has

had on the science of shooting incident reconstruction, he is the most humble man I know.

I would like to express my deep appreciation to the many law enforcement officers and crime scene investigators I have met and worked with who have the fortitude and integrity to conduct themselves professionally in the face of some of the worst acts human beings can commit on one another. While I have met my share of individuals in this profession I would not particularly care to associate with, the overwhelming majority have been some of the best people I will ever meet. Luck, fate, fortune, or destiny brought me to one of the finest police organizations in the country. I am grateful to have worked with the investigators, scientists, detectives, and supervisors of the Albuquerque Police Department.

As much as the first edition of this book was my dad's work, and this one is mine, none of it would have been possible without the strong backing of my wonderful wife Kimberly DaVia Haag, who is also a well-known and respected firearm and toolmark examiner. If I were to die tomorrow, I would feel proud and thankful to have had even a week in her company. For every bit of turbulence during the flight, she has been the tailwind making the journey better.

It is my sincere hope that readers of this text will share in my enthusiasm and passion for this work.

Michael G. Haag

Introduction to First Edition

At the time this introduction was written, the author had been employed as a criminalist and forensic firearm examiner for more than 39 years, 17 of these with the Phoenix Arizona Police Department as a criminalist and later as technical director of that laboratory, followed by another 22 as a private consultant working for prosecutors; private attorneys; educational institutions; insurance companies; law firms; firearms manufacturers; and, on occasion, private individuals. I had always found the work interesting and challenging and still do.

The concept of how science might aid the court and jury in determining what did and did not happen in the matter at trial is still an exciting one for me. Although many of us in the field of forensic science frequently disparage lawyers and the legal process, it is the anomalous trial outcome that gains our attention and generates our scorn. Most of the time juries are able to grasp the evidence we present, and that should be all that matters. What they do with that information may be, at times, disappointing to us personally but their decision is not ours to make and it may often be made on some other basis than observations and opinions derived from the physical evidence.

Working within the legal system is also fascinating. I suspect nearly all of us enjoy a good courtroom drama. A trial can be high exciting, involving verbal and mental chess on the part of lawyers and witnesses. Lives, careers, futures, personal freedom, and, in civil cases, large amounts of money are often at stake. The side that calls us as expert witnesses will usually praise our work, but may

also pressure us to extend ourselves beyond where we should go in the furtherance of their cause. Our employer's cause must *not* become our cause. Our only advocacy must be for our analysis of the evidence carried out by scientifically sound means.

As well, the reader should remember that it is often our cross-examiner's mission to make us look like biased witnesses, fools, lackeys, mountebanks, or incompetents. The witness stand is a decidedly uncomfortable environment for most scientists, and one best observed in the movies or on television rather than from the actual site. It is, and should be, a stressful place, but it is one that I have become used to and have even come to enjoy for the reasons stated earlier.

At the risk of seeming a bit immodest, it occurred to me that some readers might be interested in how I became gainfully employed (indeed, well paid) shooting guns and shooting things for a living.

I grew up in the Midwest in the late 1940s and early 1950s. Guns—some of which were always loaded—were in almost every home and farmhouse I visited. My childhood friends all had access to firearms, and after school we could often be found in a field with a rifle or shotgun. This was with our parents' permission but without them necessarily being present. It was an age of trust on their part and personal responsibility on our part.

At the age of 6 or 7 I received my first Red Ryder BB gun from my father, and this is when my marksmanship training began. Neither I nor my friends ever considered using a gun to commit a crime or to endanger someone or damage property. We certainly

never discussed shooting at one of our classmates, our school, or our teachers.

My fondest memories of my father are of getting up before daybreak, having breakfast at some roadside truck stop, and then getting into the frosty woods at dawn with the sound of crunching autumn leaves underfoot and with *my* rifle or *my* shotgun in hand. It didn't much matter whether we got any squirrels or rabbits or whatever was the quarry of the day. We walked and talked, and I learned of nature.

My father taught me firearms safety and personal responsibility. I saw firsthand that firearms, even my diminutive .22 rifle, were capable of inflicting serious and fatal wounds. Guns were *not* toys or something to be handled carelessly. And my father trusted me with guns. That meant a lot. I wish he were here to read this now. His lessons were ones that I have carried with me all of my life and have since passed on to my sons.

The use of guns in films of that time was typically portrayed as on the side of good. The Lone Ranger, Red Ryder, Roy Rogers, Gene Autry, and all the other lesser-known heroes of the Saturday matinee seldom had to shoot anyone because they were so competent and proficient in the use of their Colt single-action revolver or their Winchester rifle. They usually either shot the gun out of the bad guy's hand or simply got "the drop" on them through their superiority in firearms handling. These were classic morality plays of good over evil in which firearms were an integral part. But today the blood-soaked films from Hollywood show guns creating unimaginable death, destruction, and mayhem in the shortest time possible. They are typically possessed by the psychologically flawed and unfit. It is difficult to think of a film in the past 20 years that depicts a gun on the side of right and in the hands of an honest person of character. It seems that we have forgotten that

our special knowledge and proficiency with firearms is why we are citizens and not subjects. It is why we rightfully honor men such as Alvin York and Audie Murphy—those who grew up with firearms and used them for hunting, sport, and recreation and later used them so effectively in the defense of freedom.

In their day and in my youth, firearms were *more* accessible and readily available with little or no restrictions (other than those imposed by our parents) than they are today. And there were no school shootings, gang shootings, drive-by shootings, or any of the other senseless acts of violence committed with firearms such as we see today. As Hugh Downs (a well-known television commentator) once pointed out in reference to the present-day misuse of firearms, "It's a software problem, not a hardware problem."

But what of my life-long interest in firearms and how it relates to this book and its subject matter? I did bring home my share of rabbits and squirrels from the fields and woods of central Illinois, but hunting was never a burning passion with me. I was more interested in how far and how accurately a bullet could be fired; what it looked like after it hit or penetrated something. Why did bullets make that fascinating whining sound when I straddled a railroad track and ricocheted bullets off the iron rail after an impact at a low incident angle? I shot up a box of cartridges just to hear the sound that the departing bullets made. I even heard some of these bullets impact the ground some distance downrange and subsequently searched many times, in vain, in an effort to find one just to see if its "new" shape corresponded to the gray elliptical smear of lead at the impact site on the rail. (These characteristic impact marks are discussed and can be seen in Chapter 6.)

While shooting at sticks floating down a slow-moving stream from an old covered

bridge, I noticed that the sound of the bullet's impact with the water changed at a recurring point downrange, and it became apparent that, whereas at closer distances the bullets were entering the water, at greater distances they were ricocheting. The phenomenon I was dealing with is *critical angle*—I just didn't know the name for it in 1952. In subsequent years, I also fired many bullets vertically upward on calm days in the deserts of California and Arizona with the misplaced hope of hearing one return to the ground. (I had previously measured the roundtrip time for BBs from my Red Ryder and a Crosman pellet gun in my back yard in Illinois.)

During my high school years in Southern California, I shot competitively on a church-sponsored rifle team. Yes, dear reader, at that time churches and schools and colleges sponsored rifle teams and even supplied many of the guns! Even the University of California at Berkeley had a rifle club when I started there in 1961. Firearms and the people (including the young) who enjoyed shooting them had not yet been portrayed as they are today. I also became an avid hand loader in my teenage years (and still am today), and many of my weekends during those years involved informal target practice in various remote locations in the Mojave Desert of California. All the time I was observing and learning things about firearms and ammunition that would become useful in later years and that are now incorporated between the covers of this book.

After receiving my degree in chemistry from Cal-Berkeley, I discovered the field of Criminalistics through several courses at California State University at Long Beach and realized for the first time that I could apply and utilize my interest in firearms professionally. I began interviewing and taking tests to join the staff of several crime laboratories in Southern California, where I was living at the time. In 1965 a position for a second person in the then small Phoenix

Police Crime Lab opened up. It was the classic case of being at the right place and the right time.

During the years I worked in the Phoenix Lab, I was able to apply my interest in firearms to casework. I quickly became a member of AFTE (the Association of Firearm and Tool Mark Examiners) and began giving presentations at annual meetings and writing articles for the *AFTE Journal*. I started assembling handout materials for classes and workshops dealing with firearms' evidence and the reconstruction of shooting incidents for various organizations.

Colleagues, students from these classes, and my wife Sandi all urged me to put these things together in the form of a book. This I have now done. But there is an additional reason and it arises as a consequence of my many years of reviewing the work of others who were most often employed by government laboratories. A very troubling change has been taking place in these laboratories over the last 30 years. They are taking on the properties of a clinical laboratory where the detective or investigator selects from a menu of tests (e.g., identify the fired bullet or cartridge case with the submitted gun, measure the trigger pull of the submitted gun, check the gun's safety system for proper operation).

In this strictly reactive role, the forensic scientist no longer functions as a scientist at all. Rather, his or her role has been reduced to that of a technician. Little or no discussion between the submitter and the laboratory examiner takes place regarding the details and issues associated with the case. The technician in this "clinical lab" is simply responding to the submitter's requests. He or she may be doing the requested tests correctly and in accordance with some approved, standardized, certified, or accredited methodology, but is not fulfilling the true role of a forensic scientist.

It is the author's hope that this book not only will acquaint the reader with the many reconstructive aspects of firearms evidence but will also inspire and reorient the forensic scientists who examine such evidence. Firearms, expended cartridge cases, fired bullets, the wounds they inflict, the damage they produce, and the damage they sustain all tell a story. This book is intended to serve as a guide to understanding their language.

A couple of abbreviated quotes from G.G. Kelly, the first arms and ballistics officer for the New Zealand Police, say it all:

The gun speaks . . . and the message of the gun is there to read by one who knows the language.

The gun is a witness that speaks but once and tells its story with forceful truth to the interpreter who can understand the language.

Everything that has a basis in physics is capable of being explained. All we have to do is to find the explanation.

Lucien C. (Luke) Haag

Reference and Further Reading

Kelly, G.G., 1963. *The Gun in the Case*. Whitcombe & Tombs, Ltd., Christchurch, NZ.



Sandra M. Haag and Lucien C. Haag

Contents

Introduction xi

Introduction to First Edition

by Lucien C. (Luke) Haag xv

1. Case Approach, Philosophy, and Objectives 1

Why This Book? 1

Reconstruction: The Ultimate Goal of Criminalistics 2

Basic Skills and Approach to Casework 2

General Philosophy 5

The Scientific Method 6

Specific Considerations 7

Summary and Concluding Comments 10

2. Working Shooting Scenes 13

Introduction 13

The Team 14

At the Scene 15

Investigation Teams and Laboratory Work 27

New Techniques in Shooting Scene

Investigations 27

Summary and Concluding Comments 31

3. The Reconstructive Aspects of Class Characteristics and a Limited Universe 35

Bullet Design and Construction 35

Class Characteristics and Fired Cartridge Casings 38

Class Characteristics and Fired Bullets 41

Revolvers and the Limited Universe 47

The Worth of Weight 48

Summary and Concluding Comments 53

4. Is It a Bullet Hole? 55

The Question of Holes 55

Bullet Holes in Typical Materials 62

Summary and Concluding Comments 65

5. Some Useful Reagents and Their Application 67

Introduction 67

Testing for Copper, Lead, and Nickel 67

The Dithiooxamide Test for Copper Residues 70

The Sodium Rhodizonate Test for Lead Residues 75

Direct-Application Methods for Testing 77

"Lifting," or Transfer, Methods for Testing 79

The Dimethylglyoxime Test for Nickel Residues 81

Summary and Concluding Comments 84

6. Distance and Orientation Derived from Gunshot Residue Patterns 87

Introduction 87

Target Materials 93

Interpretation and Reporting of Results 93

GSR and Revolvers 95

The Modified Griess Test for Nitrite Residues 97

Primer Residues 100

Summary and Concluding Comments 102

7. Projectile Penetration and Perforation 105

Introduction 105

Sheetrock/Wallboard 106

Wood 110

Sheet Metal 112

Rubber and Elastics 118

Plastics 123

Summary and Concluding Comments 123

8. Projectiles and Glass 125

Introduction 125

Evidence of Glass Impact on Bullets 125

Types of Glass 129

Summary and Concluding Comments 141

9. Projectile Ricochet and Deflection 143

- Introduction 143
- Definitions 144
- Examining Ricocheted Bullets 146
- Projectile Impacts 151
- The Post-Impact Flight of Ricocheted
and Deflected Bullets 164
- Wounds from Ricocheted and Deflected Bullets 165
- Perforating Projectiles and Perforated Objects 168
- Summary and Concluding Comments 172

**10. The Principles of "Trajectory"
Reconstruction 175**

- Introduction 175
- Bullet Hole Location and Angular Components
of a Projectile's Path 175
- Measurement Procedures 177
- Nonperforating Bullet Paths 183
- Lasers' Use, Advantages, and Limitations 185
- Thoughts About Reconstructed Angles 186
- Trajectory Reconstruction Techniques, Tools,
and Supplies 187
- Summary and Concluding Comments 188

**11. Determining Bullet Track
("Trajectory") in Gunshot
Victims 191**

- Introduction 191
- Entry and Reentry Wounds 193
- Gunshot Wound Projectile Path
Determination 195
- Blood Spatter and Gunshot Wounds 197
- Survivors of Gunshot Wounds 199
- Projectile Deformation in Bodies 201
- Summary and Concluding Comments 204

**12. Trace Evidence Considerations
Associated with Firearms 207**

- Introduction 207
- Locard's Principle Revisited: Trace Evidence
Transfer and Deposit Examples 208
- Trace Evidence Sequence of Events: Three
Case Examples 212
- Summary and Concluding Comments 216

**13. True Ballistics: Long-Range
Shootings and Falling Bullets 219**

- Introduction 219
- Basics of Exterior Ballistics and Their Forensic
Application 220
- Case Situations: An Overview 225
- Maximum-Range Trajectories 229
- Potential Procedure for Long-Distance Shooting
Reconstruction 238
- Summary and Concluding Comments 243

**14. Cartridge Case Ejection
and Ejection Patterns 245**

- Introduction 245
- Scene Work—Terrain/Substrate Considerations 246
- Review of Marks on Fired Cartridge Casings 248
- Laboratory Examination of Ejected Cartridge
Cases 252
- Manually Operated Firearms 262
- Summary and Concluding Comments 262

**15. The Shooting of Motor
Vehicles 265**

- Introduction 265
- Vehicles at a Scene 266
- Projectile Strikes 270
- Summary and Concluding Comments 275

16. Shotgun Shootings and Evidence 277

- Introduction 277
- Shotgun Design and Nomenclature 279
- Choke and Patterning 282
- Shot Charges and Dram Equivalents 283
- Wads and Shotcups 284
- Powder, Gunshot Residues, and Buffer
Material 287
- The Exterior Ballistics of Shotgun Pellets 288
- Summary and Concluding Comments 292

**17. Sound Levels of Gunshots,
Supersonic Bullets, and Other
Impulse Sounds 295**

- Introduction 295
- The Nature of Gunshots and Their
Measurements 295

Human Experience and Weighted Scales in
Sound Level Meters 296

Multiple Firearms of the Same Make
and Model 307

Velocity and Muzzle Pressure Versus
Peak dB 312

Supersonic Bullets 322

A Frame of Reference for Judges and Jurors 325

Summary and Concluding Comments 328

18. Ultimate Objectives, Reports, and Court Presentations 331

Introduction 331

Explaining What Reconstructionists Do 331

Legal Challenges and Reconstructists' Role
in Litigation 332

Reports and Report Writing 336

A Test for the Reader 337

Suggested General Outline for Reports 344

Concluding Comments about the Book 350

Appendix 353

Glossary 387

Index 409

Case Approach, Philosophy, and Objectives

WHY THIS BOOK?

Many years ago I was rigorously cross-examined by an excellent attorney who had put considerable thought and preparation into his questions. My work on the case was totally reconstructive in nature, and my cross-examiner attempted to exclude my testimony on the basis that there was no such thing as “shooting reconstruction.” He went on to claim that the term was something that I had made up. At the time I could not name a single textbook entitled *Shooting Reconstruction* that dealt specifically with shooting scene reconstruction or that had “Shooting Reconstruction” in its title. Neither could I name a forensic science textbook that even had a chapter devoted to this subject.¹ To those who have familiarity with case law and tests of admissibility in the American legal system, the attorney’s argument was basically a *Frye* challenge (*Frye v. U.S.*, 1923).

With what has resulted because of the *Daubert* and *Kumho* decisions (*Daubert v. Merrell Dow Pharmaceuticals*, 1993; *Kumho Tire Co. v. Carmichael*, 1999), future challenges are likely to be raised where reconstructive efforts have been undertaken in a shooting case and the results are offered at trial. The idea for this book was the direct result of my cross-examination and is the product of nearly 40 years of applied research, casework, and trial experience in this specialized area of criminalistics.

¹There was in fact a book that dealt almost exclusively with shooting incident reconstruction when I was rigorously cross-examined some 20 years ago. Written by G.G. Kelly and first published in 1963, *The Gun in the Case* (Whitcombe & Tombs, Christchurch, NZ) is long out of print but a good read if you can find a copy. Kelly was the arms and ballistics officer for the New Zealand Police from 1929 to 1955. While I survived my cross-examiner’s attack and my testimony was allowed in the trial, I nonetheless wished that I had known of this fascinating book at the time.

RECONSTRUCTION: THE ULTIMATE GOAL OF CRIMINALISTICS

It may be useful to pause a moment and consider the very concept of reconstruction and whether it is a legitimate function of forensic science. Probably the best quotes on this subject come from a contemporary textbook on criminalistics by De Forest et al.² and are as follows:

p. 29: "Physical evidence analysis is concerned with identification of traces of evidence, reconstruction of events from the physical evidence record, and establishing a common origin of samples of evidence."

p. 45: "Reconstruction can assist in deciding what actually took place in a case and in limiting the different possibilities. Eyewitnesses to events are notoriously unreliable. People have trouble accurately remembering what they saw, particularly if a complex series of events takes place suddenly and unexpectedly. Reconstruction may provide the only 'independent witness' to the events and thus allow different eyewitness accounts to be evaluated for accuracy."

p. 294: "Crime-scene reconstruction techniques are employed to learn what actually took place in a crime. Knowledge of what took place and how or when it happened can be more important than proving that an individual was at a scene. A skilled reconstruction can be successful in sorting out the different versions of the events and helping to support or refute them."

Events that arise out of the use or misuse of firearms offer some very special and unique opportunities from a reconstruction standpoint. The wide variety of firearms and ammunition types, the relatively predictable behavior of projectiles and firearms discharge products, the chemistry of many of these ammunition-related products, and certain laws of physics may be employed to evaluate the various accounts and theories of how an event took place. To some degree this is little different from the well-known principles of traffic accident reconstruction, where the "ballistic" properties of motor vehicles give rise to momentum transfer, crush damage, and trace evidence exchanges. These phenomena are routinely used to reconstruct such things as the sequence of events, the location of one or more impacts, approximate speeds of vehicles, and so forth.

In summary and in fact, there are many criminalists and forensic firearm examiners who perform various types of shooting scene reconstruction. A distance determination based on a powder pattern around a bullet hole is probably the simplest example of a reconstruction. A shotgun range-of-fire determination based on pellet pattern diameter represents another common example. This book is an effort to describe the various principles of scene reconstruction as they relate to shooting incidents.

BASIC SKILLS AND APPROACH TO CASEWORK

From the very onset, the true forensic scientist must be proactive by finding out what the case is about. From this, he or she must then make certain scientific assessments, define the

²*Forensic Science: An Introduction to Criminalistics* by Peter De Forest, Robert Gaensslen, and Henry Lee (McGraw-Hill, 1983).