

1 **OSAC 2021-N-0019**
2 **Standard Practice for the**
3 **Documentation and**
4 **Processing of Shooting**
5 **Scenes**

6 *Crime Scene Investigation & Reconstruction Subcommittee*
7 *Scene Examination Scientific Area Committee*
8 *Organization of Scientific Area Committees (OSAC) for Forensic Science*





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Standard Practice for the

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Documentation and Processing of

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Shooting Scenes

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18 Disclaimer:

19 This OSAC Proposed Standard was written by the Crime Scene Investigation & Reconstruction
20 Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science
21 following a process that includes an [open comment period](#). This Proposed Standard will be
22 submitted to a standards developing organization and is subject to change.

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24 development by OSAC. The information in the Proposed Standard, and underlying concepts and
25 methodologies, may be used by the forensic-science community before the completion of such
26 companion publications.

27 Any identification of commercial equipment, instruments, or materials in the Proposed Standard
28 is not a recommendation or endorsement by the U.S. Government and does not imply that the
29 equipment, instruments, or materials are necessarily the best available for the purpose.



30 **Foreword**

31 This standard is meant for scene investigators who are responsible for the documentation of a
32 shooting scene and for shooting reconstructionists performing the on-scene documentation. It
33 is recognized that some shooting scenes are processed and documented by scene investigators
34 who will not be performing the final reconstructive analysis. However, their work is critical to
35 any subsequent reconstructive efforts. This standard provides guidance for shooting scene
36 preservation and minimum documentation requirements for projectile impacts and
37 trajectories. This standard cannot replace knowledge, skills, or abilities acquired through
38 appropriate education, training, empirical testing, and experience and should be used in
39 conjunction with sound professional judgment.

40 **Keywords:** *Crime scene investigation, crime scene reconstruction, shooting reconstruction,*
41 *projectile impact, trajectory analysis*



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55 **Standard Practice for Documentation and Processing of Shooting**
56 **Scenes**

57 **1 Scope**

58 This document provides minimum standards and recommendations for the documentation
59 and processing of shooting scenes that may be subject to shooting reconstruction. This
60 document covers generally accepted professional principles and operations, shooting scene
61 documentation, and shooting scene preservation. This document does not provide
62 complete protocols for conducting a full shooting reconstruction.

63 **2 Normative References**

64 ASTM Practice E620-18 Standard Practice for Reporting Opinions of Scientific or
65 Technical Experts

66 OSAC proposed standard: "Guiding Principles for Scene Investigation and
67 Reconstruction"

68 ANSI-ASB Best Practice Recommendation 068: "Safe Handling of Firearms and
69 Ammunition", 1st Edition 2020.

70 **3 Terms and Definitions**

71 For purposes of this document, the following definitions and acronyms apply.

72 **3.1**

73 **ammunition**

74 Unfired cartridges designed to be discharged in a firearm.

75 **3.2**

76 **ballistics**

77 The science and study of projectiles in motion, which is usually divided into three
78 parts: interior ballistics, exterior ballistics, and terminal ballistics.

79 **3.3**

80 **bullet**

81 A projectile designed specifically to be fired from a firearm.

82 **3.4**

83 **caliber**

84 The nominal diameter of a projectile or the nominal inner diameter of a barrel, or a
85 term also used to designate the specific cartridge(s) for which a firearm is chambered.

86 **3.5**

87 **cartridge case / casing**

88 The fired or unfired component of metallic ammunition, the purpose of which is to
89 hold the primer, propellant, and projectile.

90 **3.6**

91 **cartridge case ejection patterning**

92 The use of the spatial relationship between a firearm and ejected cartridge
93 cases/cartridges in order to approximate gun location in a scene at the time of
94 ejection.

95 **3.7**

96 **defect**

97 A generic term for any surface damage.

98 **3.8**

99 **directionality**

100 The property of a trajectory that describes which way a projectile was traveling.

101 **3.9**

102 **distance determination**

103 The process of determining how far away the muzzle of a firearm was from a target at
104 the time a shot was fired, based on one or more methods such as gunshot residue,
105 petal slap, pellet patterning, or buffer patterning.

106 **3.10**

107 **exterior ballistics**

108 The branch of ballistics that deals with a projectile's flight in air.

109 **3.11**

110 **firearm**

111 Any weapon designed to expel a projectile with the energy generated by combustion.

112 **3.12**

113 **gunshot residue**

114 **GSR**

115 The total of all residues resulting from the discharge of a firearm, typically constituted
116 of nitrites and lead, as well as unburned and partially burned gunpowder particles,
117 primer residues, carbonaceous material plus metallic residues from projectiles,
118 fouling, and any lubricant associated with the projectiles.

119 **3.13**

120 **horizontal angle**

121 The angle in a horizontal plane typically between the path of a bullet and an object
122 that was struck, also known as azimuth angle.

123 **3.14**

124 **interior ballistics**

125 The study of a projectile's initial acceleration and performance in the weapon and the
126 related processes.

127 **3.15**

128 **non-penetrating impact**

129 Projectile damage where the projectile strikes but does not penetrate a target.

130 **3.16**

131 **pellet patterning**

132 The distribution of shot fired from a firearm that may be used to estimate the
133 muzzle-to-target distance.

134 **3.17**

135 **penetrating impact**

136 Projectile damage where the projectile entered and did not exit a target.

137 **3.18**

138 **perforating impact**

139 Projectile damage where the projectile entered and exited a target.

140 **3.19**

141 **primer residue**

142 A subcategory of gunshot residue considering only chemicals generated from the
143 priming mixture. Typically composed of very small particles containing lead, barium,
144 and antimony, and detected using scanning electron microscopy.

145 **3.20**

146 **projectile**

147 An object propelled with an initial velocity then acted upon by gravity, air drag, and
148 other outside forces.

149 **3.21**

150 **projectile fragment**

151 Any portion of a projectile that retains characteristics permitting it to be identified as
152 having been part of a projectile.

153 **3.22**

154 **projectile impact, noun**

155 Surface damage determined to have been caused by a projectile.

156 **3.23**

157 **range**

158 The distance from a firearm to the initial projectile impact.

159 **3.24**

160 **scene reconstruction**

161 The utilization of information gathered from the investigative process to develop or eliminate
162 possible explanations for how an incident occurred.

163 **3.25**

164 **shooting reconstruction**

165 A scene reconstruction focused on the discharge of a firearm(s).

166 **3.26**

167 **target**, *noun*

168 Any object struck by a projectile, regardless of whether it was struck intentionally.

169 **3.27**

170 **terminal ballistics**

171 The branch of ballistics that deals with the projectile's impact with a target.

172 **3.28**

173 **trajectory**

174 The arched path that a projectile follows in flight, typically modeled as a straight line
175 for short-range paths.

176 **3.29**

177 **trajectory analysis**

178 The determination of a projectile's flight path.

179 **3.30**

180 **vertical angle**

181 The angle in a vertical plane typically between the path of a bullet and level, also
182 known as elevation angle.

183 **3.31**

184 **wound ballistics**

185 A subset of terminal ballistics that considers projectile impacts to tissue and tissue
186 simulants.

187 **4 Procedures**

188 This standard establishes the minimum requirements to document a shooting scene
189 for reconstruction. As established in the Guiding Principles for Scene Investigation and
190 Reconstruction, the specific circumstances at a scene may require deviation from

191 established standards. Deviations from this standard shall be based on specific
192 articulable circumstances and shall be documented.

193 **4.1 Shooting Scene Preservation**

194 This section applies specifically to shooting incidents and should be blended with
195 other scene processing procedures, as necessary.

196 4.1.1 The location of firearm evidence in a scene can have critical implications to a
197 shooting reconstruction, for example: impact sites, fired cartridge cases, firearms,
198 and/or other ammunition components. Proper location documentation of these
199 specific type(s) of evidence shall be conducted.

- 200 a) Each fired cartridge case shall be individually labeled, headstamps described or
201 photographed, and its location documented. If cartridge cases of the same type
202 are commingled, they may be documented and collected together.
- 203 b) Firearm conditions shall be documented to include safety position, cylinder
204 position for revolvers, loaded status, damage, evidence of malfunction, and
205 trace evidence.

206 4.1.2 Alterations to the scene that occur after an incident (e.g., first responder
207 involvement, animal activity, weather, time), can greatly affect shooting scene
208 reconstruction and any known or suspected alterations shall be documented.

209 4.1.3 In the course of shooting scene processing, it may be necessary for the
210 investigator to move objects within the scene in the interest of the investigation (e.g.,
211 search, body movement). This is permissible, but actions shall be taken first to record
212 the object's location to allow the object to be properly replaced for analysis, if
213 necessary.

214 **4.2 Projectile Impact Documentation**

215 All projectile impacts shall be documented to include photography, labeling, projectile
216 impact characteristics, and 3-dimensional location.

217 4.2.1 Photography

218 Projectile impacts shall be photographically documented to record their location,
219 scene context, and physical characteristics.

- 220 a) In addition to standard scene photography, photography of projectile impacts
221 shall include sufficient overall and mid-range images to establish the
222 relationship of projectile impacts with each other and other objects in the scene
223 and close-up images taken with the sensor plane parallel to the impact.
- 224 b) Photographs shall be taken with and without a scale/label.

225 4.2.2 Labeling

226 Projectile impacts shall be given a unique identifier and that shall be recorded in
227 photographs, notes, and sketches/diagrams.

228 4.2.3 Projectile Impact Characteristics

229 Projectile impacts shall be examined and their characteristics documented. These
230 should include, but are not limited to:

- 231 a) Physical Characteristics
- 232 i) size (width, length)
 - 233 ii) as non-penetrating, penetrating, or perforating
 - 234 iii) target material
 - 235 iv) specific features or characteristics of the impact that are used to further
236 evaluate the projectile impact (e.g., depth)
 - 237 v) any other observable forensic evidence present (e.g., trace evidence)
- 238 b) Chemical Characteristics
- 239 i) if a projectile impact is suspect, the use of chemical testing techniques
240 for traces of bullet metals should be employed
 - 241 ii) copper and lead tests (e.g., dithiooxamide (DTO) & sodium rhodizonate
242 tests, respectively) are commonly used field tests

243 4.2.4 3-Dimensional Location

244 The 3-dimensional location of each projectile impact shall be measured using a
245 coordinate system that is clearly defined and recorded in the notes or data collected.

246 **4.3 Trajectory Measurement**

247 In order to measure a trajectory, the following parameters, when practicable, shall
248 include:

249 4.3.1 Directionality

250 A trajectory is often represented by a line traveling in only one direction. When
251 possible, the direction of travel shall be documented.

252 4.3.2 Impact Site(s)

- 253 a) each trajectory shall be associated with at least one reliable projectile impact
- 254 b) if more than one projectile impact is associated with a single, defined trajectory
255 (e.g., primary, secondary, etc.), all the projectile impacts that can be tracked
256 along that trajectory and their sequence shall be documented

257 4.3.3 Path

258 The projectile's path can be described with either of the following:

259 a) Horizontal Angle and Vertical Angle

- 260 i) angles are commonly reported to a degree (not tenths or hundredths of
- 261 a degree)
- 262 ii) for both horizontal and vertical measurements, zero (0) must be defined
- 263 and documented
- 264 iii) the horizontal angle is typically measured relative to the object that was
- 265 struck
- 266 iv) the vertical angle is typically measured from level relative to gravity

267 b) Three-Dimensional Representations

- 268 i) photographs of visual representations of the trajectories from which
- 269 horizontal and vertical angles can be measured
- 270 ii) three-dimensional survey data of the trajectories

271 4.4 Projectile Recovery

272 After all other on-scene documentation and analysis is complete, every reasonable
273 effort shall be made to locate and recover projectiles or projectile fragments from
274 impacted objects.

- 275 a) All reasonable efforts shall be made to minimize damage to projectiles or
- 276 projectile fragments during this process.
- 277 b) When a projectile or projectile fragment can be associated with a projectile
- 278 impact and/or trajectory, this shall be documented in the notes.
- 279 c) The section of a target containing an embedded projectile may be collected for
- 280 a more comprehensive attempt for recovery in a controlled environment.
- 281 d) If a projectile cannot be found or physically recovered, the reasons shall be
- 282 documented.
- 283 e) An accounting of the relative numbers of projectile impacts, projectiles, and
- 284 cartridge cases shall be completed when feasible.

285 **5 Examples of Additional Relevant Evidence Types and Examinations**

286 **5.1** Scene investigators shall be aware of other types of forensic evidence that can
287 yield reconstructive value to later shooting reconstructions. Appropriate development,
288 documentation, and collection techniques shall be applied for all evidence discovered
289 at shooting scenes.

290 **5.2** Additional relevant evidence types can include, but are not limited to:

- 291 a) Firearms Identification. The identification of ammunition components as
292 having been fired from a particular firearm can allow that firearm to be
293 associated with a specific trajectory and/or location in the scene.
- 294 b) Gunshot Residue (GSR) Distance Determination. GSR patterns can be used to
295 determine a muzzle-to-target range at the time a shot was fired, which can
296 further help to place a firearm in the scene.
- 297 c) Pellet Patterning. Pellet patterns can be used to determine a muzzle-to-target
298 range at the time a shot was fired, which can further help to place a firearm in
299 the scene.
- 300 d) Primer Residue Analysis. Primer residues deposited on objects near a
301 discharged firearm, most notably the shooter, can be used to associate an
302 individual as having been in the vicinity of a firearm discharge.
- 303 e) Cartridge Case Ejection Patterns. A cartridge case pattern analysis can be used
304 to position a firearm within a scene.
- 305 f) Exterior Ballistics. Analysis of the long-range reconstruction of a bullet's path
306 through the atmosphere.
- 307 g) Terminal and Wound Ballistics. Analysis which can include bullet deformation,
308 penetration depth, and wound profiles.
- 309 h) Trace Evidence. Trace evidence can indicate the type of projectile or the
310 presence of an intervening target. Intervening targets can have a destabilizing
311 effect on the bullet's trajectory and shall be considered when drawing
312 conclusions from an evaluation of the ballistic evidence.
- 313 i) Bloodstain Pattern Analysis. A bloodstain pattern analysis is a type of scene
314 reconstruction that can be helpful in locating individuals in the scene and
315 associating them with movements or firearms events.
- 316 j) Audio and Video Recordings. Audio and video recordings of a shooting can be
317 used to establish specific timelines, relative chronologies, and the positions and
318 movements of individuals in the scene.
- 319 k) Fingerprint Examination. Latent prints processing can reveal an association to
320 individuals who have handled some part of the evidence or scene in a shooting
321 reconstruction.
- 322 l) DNA Analysis. DNA analysis can reveal an association to individuals who have
323 handled some part of the evidence or scene in a shooting reconstruction.

324 **6 Recording and Reporting Observations**

325 6.1 Notes shall be taken contemporaneously with the examination, which records
326 pertinent observations and measurements. Notes shall:

- 327 a) provide the basis for conclusions and opinions
- 328 b) be in a common format (e.g., written, typed, diagrammed, photographed,
329 scanned, audio recorded, video recorded)
- 330 c) be retained such that a peer or reviewer can thoroughly understand what was
331 done
- 332 d) contain relevant observations regarding factors that may affect uncertainty or
333 confidence in a measurement or conclusion

334 6.2 When a report is prepared, guidance on report preparation may be found in
335 ASTM Practice E620-18.

336 **7 Commonly Used Equipment**

- 337 a) cameras/imaging equipment
- 338 b) trajectory rods/probes
- 339 c) lasers
- 340 d) strings
- 341 e) protractors
- 342 f) inclinometers
- 343 g) plumb bobs
- 344 h) 3D scanners
- 345 i) total stations
- 346 j) laser measurement tools
- 347 k) micrometers
- 348 l) calculators
- 349 m) levels
- 350 n) tripods
- 351 o) compass
- 352 p) tape measures/scales
- 353 q) chemical reagents
- 354 r) carpenter's square

355

Appendix A **(informative)**

356

357

Bibliography

358 This is not meant to be an all-inclusive list as the group recognizes other publications on this
359 subject may exist. At the time this document was drafted, these were some of the publications
360 available for reference. Additionally, any mention of a particular software tool or vendor as
361 part of this bibliography is purely incidental, and any inclusion does not imply endorsement by
362 the authors of this document.

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