Explosives and Hazardous Devices Examinations

Table of Contents

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1 INTRODUCTION

This technical procedure (TP) is designed to provide a general overview of the approaches used by explosives and hazardous devices personnel in the forensic examination of evidence. The basic procedures described herein are geared towards the examination of improvised explosive devices (IEDs), however, the principles are the same for the examination of other hazardous devices, such as, but not limited to, military explosive devices, commercial explosive devices, improvised incendiary devices (IIDs), and hoax devices, hereafter referred to collectively as devices. Specifics related to the examination of individual items often found in bombing evidence are contained in separate TPs.

2 SCOPE

This TP describes the process for explosives and hazardous devices examinations and apply to personnel who examine devices such as, but not limited to, military explosive devices, IEDs, IIDs, hoax devices, associated components, and their post-use remains to determine identifying information and functionality.

3 EQUIPMENT

Refer to specific component TPs for a list of items that can be used by explosives and hazardous devices personnel for the forensic examination of evidence. Personnel should choose the most appropriate items based on the nature of the evidence.

4 PROCEDURE

The primary objective of explosives and hazardous devices personnel is to determine the physical construction and functioning characteristics of devices, or portions thereof, submitted as evidence, with the goal of ascertaining whether the device or components possess the functional characteristics and/or design elements of a weapon and therefore meets the technical elements of a destructive device.[1] The methodology for the forensic examination of can be broken down into six (6) steps:

Step 1 – Segregation

Step 2 – Recognition

Step 3 – Identification

Step 4 – Function Determination (i.e., functionality)

Step 5 – Comparison

Step 6 – Destructive Device Determination

It is important to note that the pressures (millions of pounds per square inch [psi]) and temperatures (thousands of degrees Kelvin) potentially generated in an explosive reaction impose an inherent limitation to this examination methodology; some of the items can be so

[1] 26 U.S.C. § 5845(f) and 18 U.S.C. § 921(a)(4)

severely damaged that it may be impossible to complete every step of the process. These steps are listed only as an outline of the process used by personnel while examining evidence. The steps may be conducted in parallel or in any logical sequence depending on the nature of the evidence.

4.1 Segregation

Since devices can be constructed from a diverse multitude of items, the first step in the examination process is the segregation of relevant items present in the evidence. Often items submitted as evidence were not part of the device, consisting instead of background debris from the scene of the explosion. Proper segregation of relevant evidence often requires communication with those who were on scene and is accomplished in part with the application of step two (2).

As part of the segregation process, explosives and hazardous devices personnel will separate out items of forensic value for further examinations, and with the aid of personnel from other FBI Laboratory units, select items to go to other forensic disciplines for examination. All items deemed forensically relevant will be photographed following the Evidence Photography TP.

4.2 Recognition

Devices require an energetic material (EM) and a mechanism that causes this material to explode. The EM is called the main charge, also referred to as the main charge explosive or explosive main charge, and the mechanism that causes the main charge to explode is referred to as the initiating, or fuzing, system. The purpose of an initiating system is to supply energy to function the main charge. Initiating systems are further categorized as being either non-electric or electric. For example, anything that can undergo combustion or create sufficient heat to induce chemical decomposition in a heat-sensitive EM can potentially serve as a non-electric fuzing system. Electric fuzing systems tend to be more complex, usually requiring multiple electrical components such as, but not limited to, batteries, wire, and switches.

Based on these general principles, submitted items will be visually and/or microscopically examined to find those which could potentially function as components of a device.

Based on the visual and/or microscopical examinations, explosives and hazardous devices personnel will attempt to assign general attributes, or class characteristics, to items of evidence that could potentially function as part of the device (e.g., determining that a particular item is a portion of a battery). If possible, all items assigned general attributes will be taken to Step 3 of the examination process described in section 4.3.

4.3 Identification

The process of component identification requires the visual and/or microscopical analysis of physical characteristics such as, but not limited to, material type, shape, and color. Other physical characteristics can be examined through measurements, including, but not limited to, sizes, angles, and voltages. These measurements are not traceable but are used to determine the dimensional value of technical parameters that may be relevant to the identification of a particular component and determining its possible manufacturing source. As the physical

measurements outlined in device-related TPs are not traceable they are not subject to detailed error analysis to determine measurement uncertainties.

Each component determined to be part of the device will be attributed to a potential manufacturing source, as appropriate. Information such as the potential component manufacturer, distributor, brand, and type will be determined, as applicable. If required, a *conclusive* determination as to the identification of an item will be made only if the source of the item is corroborated through direct communications with the distributor or manufacturer of the item. Specifics about a component, such as, but not limited to, availability and common uses, that might aid investigators should be sought out, as appropriate.

4.4 Function Determination

After item identification is completed, explosives and hazardous devices personnel will attempt to determine the role of the items in the functioning of the device. It is emphasized again for this step that the destruction created by the forces from the explosion of a device may render a definitive determination of how it functioned impossible. Explosives and hazardous devices personnel must use their expertise to opine on the role of the components in the functioning of the device, as well as how the overall device might have been constructed and functioned. Circumstances of the incident surrounding the recovery of the device, or its components, may be used when making this determination. Caution must be taken not to overstep the bounds of what can be logically inferred from the examinations and facts of the case.

4.5 Comparison

There are two (2) general types of comparison examinations that occur in explosives and hazardous devices examinations: device/known origin comparisons (between the components of a device and items of known origin) and inter-device comparisons (comparison examinations between the components of multiple devices). In both examinations, visual and/or microscopical comparisons will be made between the physical characteristics of the items to determine if there are discernable differences with respect to those characteristics. These types of examinations involve the comparison of observable characteristics, such as, but not limited to, component shapes, colors, and markings. The examinations may also involve comparison of measured, physical characteristics, such as, but not limited to, sizes, angles, and voltages.

4.5.1 Inter-Device Comparison

Visual and/or microscopical and/or measurement comparisons are conducted between components (and their respective functioning) of multiple devices. Examinations are applied towards, but are not limited to, serial bombing investigations where the purpose is to determine if otherwise unrelated devices share common componentry, designs, or construction characteristics.

4.5.2 Device/Known Origin Comparison

Visual and/or microscopical and/or measurement comparisons are conducted between the components of a device and items of known origin, such as, but not limited to, the recovered

constituents of an exploded device and components recovered from the search of a suspect's residence.

4.6 Destructive Device Determination

An "explosive device" or "IED" describes what in lay terms would commonly be called a "bomb" or "homemade bomb." In legal terms, however, "explosive device" and "IED" have specific meanings and could include things such as commercial and improvised fireworks. The legal term for what most statutes would call a bomb or IED is "destructive device."[2] A destructive device is a device designed to serve as a weapon. As "designed" infers an element of intent, the jury is the final arbiter as to whether an intact device or device components constitute the legal definition of a destructive device.[3] Furthermore, the courts have used various approaches regarding interpretation of the destructive device statutes.[3-7] The explosives and hazardous devices examiner assists the jury by offering an opinion as to whether the device or device components possess the functional characteristics and/or design elements of a weapon. After Steps 1 – 5 of the examination process are completed, Step 6 is performed to determine whether the device possesses the attributes of a weapon and therefore meets the two technical elements of a destructive device (i.e., an explosive device that has the functional characteristics and/or design elements of a weapon). These two elements are purely technical, not legal, and are not meant to infer the intent of the individual(s) who constructed the device. The physical examination of a device or its components taken outside the context of utilization may not allow the destructive device determination to be made due to the absence of characteristic weapon design elements. In said absence, the way the device was used is taken into consideration to determine its capability to function as a weapon.

5 LIMITATIONS

The following are general limitations of the explosives and hazardous devices examination process described in this TP:

Conclusive identifications of the source of an item may not be realized in every case due to the absence or alterations of specific manufacturer or other unique markings on items of evidence.

The physical characteristics, such as, but not limited to, material type, shape, and color of all evidentiary items are based on visual and/or microscopical observations, unless otherwise noted. Other parameters such as, but not limited to, distances, angles, and voltages associated

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[2] Department of Justice's Executive Office for United States Attorneys. Forensic Science Primer: Explosives. (Retrieved from DOJNET at https://dojnet.doj.gov/usao/eousa/ole/tables/subject/bomb.htm#stat)
[3] 26 U.S.C. § 5845(f) and 18 U.S.C. § 921(a)(4)
[3] *United States v. Hammond,* 371 F.3d 776 (11th Cir. 2004): provides an example of the Subjective Standard used by courts in destructive device determinations
[5] *United States v. Johnson,* 152 F.3d 618 (7th Cir. 1998): provides an example of the Mixed Standard used by courts in destructive device determinations
[6] *United States v. Oba,* 448 F.2d 892 (9th Cir. 1971): provides an example of the Subjective Standard used by courts in destructive device determinations
[7] *United States v. Psonjak,* 457 F.2d 1110 (2nd Cir. 1972): provides an example of the Objective Standard used by courts in destructive device determinations

with individual items are based on physical measurements and are approximate, unless otherwise noted. Should a more complete characterization of these items be required, additional examinations can be requested of the appropriate forensic discipline. Diagrams such as, but not limited to, drawings and schematics are not to scale, unless otherwise noted.

The explosion and/or fire resulting from the functioning of a device can cause extensive damage, such as fragmentation, charring or other severe alterations to items of evidence. Due to the destructive nature of these types of energetic events, conclusive determinations as to the recognition and identification of specific device components, as well as the exact design and functioning of the device, may not always be realized in every case.

The two elements that must be met to make an affirmative destructive device determination are that the device or device components constitute an explosive or incendiary device and that the device or device components possess the functional characteristics and/or design elements of a weapon. These two elements are purely technical, not legal, and are not meant to infer the intent of the individual(s) who constructed the device.

In the absence of characteristic weapon design elements, physical examination of a device or its components taken outside the context of utilization may not allow a destructive device determination to be made. In said absence, an examiner may have to consider the circumstances in which the device was used to determine its capability to function as a weapon; this consideration is not meant to infer the intent of the individual(s) who constructed the device.

Explosives and hazardous devices personnel must determine which examinations are appropriate based on what items have been deemed of forensic value. Further guidance is provided in the Explosives and Hazardous Devices Report Writing Guidelines TP.

6 SAFETY

Safety protocols are contained within the FBI Laboratory Safety Manual as well as specific TPs and will be observed at all times.

7 REVISION HISTORY

Revision	Issued	Changes
04	09/15/2022	Updated to new document template and updates made throughout for clarity.