Explosives

It has never been easier to make a bomb. Fanatical patriots, religious zealots, and plain old-fashioned social misfits can easily find recipes on the Internet, and the materials are widely available. Forensic techniques cannot stop people making bombs, but they can help to catch bombers before they strike, or trace them by analyzing the aftermath of a blast.

The anatomy of a bomb is simple. A timing device or a remote control is needed to start the process. This triggers a primary charge, which is a tiny but easily ignited charge used to spark the explosion. (The timer and the charge combine to be called a detonator). Then a main explosive does the deed – this is a material that reacts violently to the small charge, creating a lot of gas incredibly quickly, producing a pressure shock wave that causes the damage.

At the bomb scene

An explosion does not completely consume these components. Instead, the blast scatters the pieces, and has been known to destroy as little as 1/20th of the bomb's casing and mechanism. Because so much survives, bomb scenes potentially offer rich pickings for forensic investigators to analyze—if they can find them.

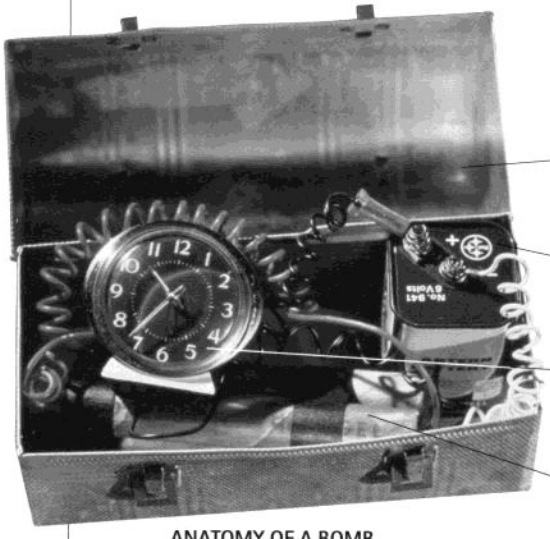
The procedure for finding the remnants of a bomb differs from any other crime-scene search only in detail. The bomb-scene manager first estimates the likely center of the blast, measures how far debris was thrown, then cordons off an area 50% bigger. Measuring and mapping follows, and the scene is divided into grid squares so as to record where the evidence is found.

Walk-through

The search for evidence typically begins with a walk-through, with searchers moving slowly, line-abreast to recover any obvious evidence. The telltale signs they are looking for are jagged fragments, possibly dusted with soot. Once this search is complete, the debris in each grid square is swept into a heap—using new or sterilized tools, to prevent contamination. Each pile is then literally sieved for evidence.

Clearing the scene reveals the seat of the blast. This is where traces of explosive are most likely to be found, so officers swab the area, carry out a fingertip search, then dig out some of the crater itself for testing.

If the bomb was hidden in a vehicle, its remains are winched on to a tarpaulin, then "gift-wrapped" in another one, so that no evidence is lost on the way to a secure area where it can be examined in detail.



The purpose of casing is to disguise the bomb, but it may also hold metal fragments to wound those nearby.

Low-tech bombs often short out a battery across a thin wire. This creates enough heat to start the explosion.

The crudest (and most unreliable) of timers rely on the moving hands of a clock closing electrical contacts.

Commercial explosives make for compact bombs. Sacks of homemade explosives are needed to produce the same blast.

ANATOMY OF A BOMB

IRA BLAST ▲
In 1993, an IRA truck bomb parked in London's business district killed one person, injured 44, and caused damage estimated at hundreds of millions of dollars.

Analyzing the explosive

The search for explosives begins at the crime scene, with reagents that change color on contact with any fuel residues, and sniffers, or vapor analyzers (see p. 108). Nevertheless, bomb scene searches are rather hit-and-miss affairs, and the real work of analysis is done at the lab.

Fragments that may carry traces of unburned explosive are firstly examined microscopically to study the shapes of the residue particles, and then they are washed in water and acetone to get the particles into a testable solution. Any residues extracted from this are then screened and analyzed using reagent spot tests and

BOMB SCENE PROTOCOL:

1	*Treat those injured in the blast, put out fires, and make the building safe.*
2	*Recovery of the dead must preserve evidence: one might be the bomber.*
3	*Secure and map the scene.*
4	*Search for larger evidence.*
5	*Sift debris in grid-squared zones for any remains of bomb.*
6	*Clear seat of blast, test for explosives, and remove samples.*
7	*Fingertip search of crater.*

OKLAHOMA BOMB SCENE
Forensic engineers called to the scene of the Oklahoma bombing were able to estimate the size of the fertilizer–diesel bomb by studying the structural damage that it caused.

TYPES OF EXPLOSIVE

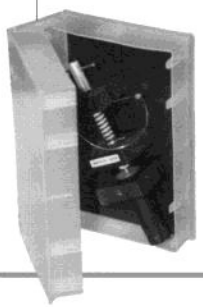
There are a number of types of explosive out there for determined people to get hold of—if they have the right contacts. Other types can be made in their kitchens with readily available household products.

◀ MILITARY EXPLOSIVES
Munitions are more tightly controlled than industrial explosives, though identical compounds are used in both kinds.

HOMEMADE ▶
Gasoline and diesel burn explosively when mixed with an oxidizer, though large quantities may be needed.

COMMERCIAL EXPLOSIVES ▶
Used in quarrying, tunneling, and industry, commercial explosives are stable and often waterproof. Semtex has both military and commercial uses.

◀ HIGH EXPLOSIVES
Oxidizer and fuel are combined at molecular level in high explosives. When triggered by a small detonating charge, high explosives such as PETN decompose rapidly, creating a large pressure wave.



◀ LOW EXPLOSIVES
Gunpowder used in shotgun cartridges is a low explosive, but can still make an effective terror bomb. An extortionist used it to make this VCR bomb.

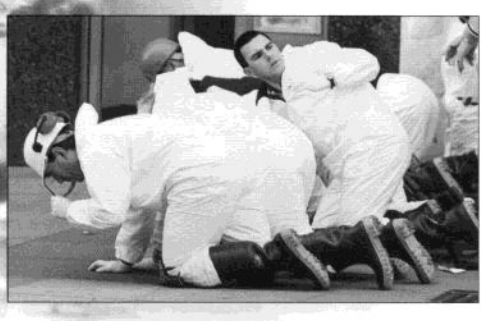
either thin-layer chromatography, high performance liquid chromatography, or gas chromatography/mass spectrometry (see p. 83).

Forensic analysts use similar testing techniques to check for the presence of undetonated explosives—perhaps when searching a bomb factory, or testing for the presence of explosives on the hands, clothes, or possessions of a suspected bomber.

Studying other traces

Though reduced to minute fragments, a casing or trigger mechanism can lead investigators to a bomb's manufacturer. Fragments of bomb components occasionally bear the fingerprints of the bomber, but more often the parts themselves can be traced to their source. A tiny chip of a circuit board, for example, helped trace the Lockerbie bomber (see p. 116). To make this task easier, the FBI's Explosives Unit maintains a vast collection of commonly used bomb components, including batteries, detonators, and control devices. A database of recovered bomb parts also enables investigators to identify links between blasts.

Determining how a bomb was set off can help security forces devise counter-measures. For example, the discovery that IRA terrorists were using model-aircraft radio controls to detonate bombs led to jamming of the radio frequencies they used. The terrorists responded by switching to radar, triggering the bomb with a radar gun normally used by traffic police. When further counter-measures made this method of triggering impossible, the bombers adopted a light-sensitive "slave" unit normally used by photographers for cordless flash synchronization. When the slave detected a sudden light pulse from a tiny hand-held flash, it closed a circuit, detonating the bomb. The deadly game of forensic leapfrog ended only when a political truce brought the bomb attacks to an end.



◀ FINGERTIP SEARCH
Since debris from bombs is reduced to the tiniest fragments, there is often no alternative to a painstaking hands-and-knees search of the crime scene. Here, a bomb had exploded in a sidewalk trash can.