Liquid Explosives: Can we detect, prevent and respond to this threat?

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Security Solutions International is the leading national training company for Homeland Security from awareness training for first responders, to hospital and medical response and even helicopter and marine emergency response to acts of terror. The SSI training program is based on Israeli experience that is contextualized for US First Responders.

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Some of the ideas in this article were recently presented to the Airports International Council Annual conference in Seattle, WA.

A Simple Plot

The plot was simple: take 14 bottles of cleaning lens solutions aboard 11 Airliners all heading to the USA. Inside the bottles, instead of cleaning lens solution, there would be deadly and unstable Nitroglycerin which is completely odorless.

The bombs were to be detonated using simple Casio watches as timers, and the detonators were to be simple small flashlight bulbs that would use the filament to ignite a lethal mixture.

The plot would have been one of the most deadly in the history of Terrorism. An estimated 4000 people might have been killed and Commercial Aviation would have been brought to its knees.

Of course, we all know this did not happen because on August 10th the British Authorities arrested the bomb plotters and that very same morning travelers in the US were already subject to discarding perfumes and other toiletries, drinks, and now we are all subject to the well known security process of the clear plastic bag, right?

Wrong. I am not speaking about the August 10th London plot, but a plot hatched more than a decade before and planned for July 21st 1995.

We are speaking about Bojinka (which literally means “Boom” in Afghani). The plot put together by Ramzi Youssef, the nephew of Khalid Shaik Mohamed, the bomber of the 1993 attack on the World Trade Center, and the mastermind of the 9/11 attacks respectively.
In other words, the fact that the TSA has belatedly been made aware of liquid explosives does not mean they have not been a very important part of the terrorist arsenal for a very long time. Bringing down an airliner requires very little explosive force due to the already pressurized cabin.

**Should Law Enforcement be concerned?**

However, liquid explosives have rarely been used in recent Suicide bombings and certainly not in VBIED’s where the quantities that are deployed and the obvious instability of many liquid explosives mitigate against their use. So should Law Enforcement be concerned about liquid explosives?

The August 10th plot to bomb Airlines traveling to the US from the UK offers a partial answer and additional questions. Although the investigation is still on-going, it now appears that Lucozade bottles, with false bottoms would be used. The Lucozade, (an English version of Gatorade) would be in the top part of the bottle, while the false bottom would contain the explosives. It has been reported by authorities here that the liquid would be used to make either triacetone triperoxide TATP or/and hexamethylene triperoxide diamine. These would be mixed on board presumably. Either explosive can be easily activated by friction, heat or electrical charge.

Some have questioned this. A British Army Intelligence Officer with decades of anti-terror and explosives experience said that these explosives could not have possibly been armed on the planes. But the Intelligence Officer has not studied his terror history.

The same Ramzi Youssef was able to plant a bomb with 1/10th the material that he intended to use in the major Bojinka plot on an airliner. He boarded a Philippine Airlines Flight bound for Manila stopping at Cebu. He was able to arm his Nitroglycerin bomb in the lavatory of the airplane and place it under a seat in the plane. Four hours later the bomb went off and killed a Japanese business man and caused many injuries but the mini-version did not bring down the plane.

Terrorist’s are nothing but inventive when it comes to achieving their aims. Any one knows that a good size bottle of Nitro, exploded at crowded venues such as stadiums or theatres can cause fatalities but the resulting panic that ensues means many more deaths and injuries. In fact, the very first test by Ramzi Youssef of his liquid bomb prototype was in a Manila theatre, where it caused several injuries.

Law Enforcement should definitely be concerned, even if they are not directly responsible for Aviation security. Damage can be caused in many other scenarios and venues.
Defining Liquid Explosives

There are several types of liquid and Gel explosives that Law Enforcement should be familiar with, especially because some of these are very volatile and even picking up a bottle of say, Nitroglycerine and shaking it could cause an explosive. Force safety must be of paramount concern when answering a call to a suspected bomb making site. No untrained officers should ever touch anything when there is a suspicion of bomb making activity without having Bomb Techs present to clear the area before any investigation begins.

Familiarization with the types of explosives is also vital in detecting activity in bomb IED labs. You may answer a call about suspicious activity and fail to recognize the substances.

1. WaterGel explosives were developed to replace dynamite. They are packaged in plastic and look like very large sausages. They require a detonator and are not subject to heat, friction or electrical detonation.
2. Astrolite G and Astrolie A-1-5 (basically the addition of one additional component are extremely dangerous but stable liquid explosives. There are simple formulas for putting these together for anyone with an Internet connection. Both are claimed to be the most powerful non-nuclear explosive (Astrolite G) and A-1-5 version is claimed to be the world’s highest detonation velocity explosive. Both are clear liquid. These use mechanical or electrical detonation.
3. Two component Kinepak is commercially available and looks like a syrupy red liquid which when mixed with a white powder substance creates a very powerful explosive.
4. Nitroglycerin is the most instable of explosives but extremely powerful and detonation with explosion makes it much more powerful. It is a combination of sulphuric and nitric acid. It can be stabilized by a combination of freezing or reconstitution (cotton balls soaked and then dried) or the addition of compounds that can then be removed. The liquid looks clear but with aging becomes brown.
5. Incendiary chemicals are widespread and in a suitable container may cause large scale damage. Gasoline, Gelled Gasoline, chlorate sugar and thermite are some examples.
6. Tracetone Triperoxide (TATP) is much in favor with Middle Eastern Terrorists and may be so because of its ease of preparation but it is not a liquid explosive. It is a crystal solid form explosive but it is made up of readily available liquids. All it takes is acetone, hydrogen peroxide (3% medicinal peroxide is not concentrated enough), and a strong acid like hydrochloric or sulfuric acid.

It is important to realize that new substances that have the property of releasing large quantities of gas at high velocity (the essentials of an explosive) are being developed in terrorist bomb labs regularly so that the effort of classification and description is difficult.
Detecting Liquid Explosives

There are several problems with detecting liquid explosives. For this reason they have become more popular with terrorists. Solid explosive detection is relatively advanced. Also, just like Ramzi Youssef, terrorists are constantly experimenting with different substances that will be useful to their aims either as rapid inflammation or explosive compounds. The most critical problem is the difference between organic and inorganic liquid explosives. This means that two types of detection need to be used.

The publicity of the August 10th plot has given rise to an entire industry determined to fill the holes left to terrorists to deploy these weapons.

Rapiscan Systems is developing four different devices that could detect liquid or Gel explosives but they are relatively expensive. Machines can cost up to $250,000 each.

For high transit situations the devices have difficulties. Each bag must be placed in a closed compartment and each and every bag would have to go through this process something that would cause immense delays whether at the entrance to a Football Game or at an airport.

A machine that detects explosives in liquid or solid form, does so by bombarding it with energy such as radio waves or neutrons software then processes the result to determine the chemical compound in the innocuous container.
Millimeter wave technology such as Defendertech’s camera system can detect a bottle that is hidden under a person’s clothing without being invasive such as X-Ray machines.

Despite all the efforts, terrorists come up with new compounds and there are certain compounds that have belied testing.

For example TATP has posed special problems for detection because it lacks a metal component or nitro groups that would make them amenable to detection by standard screening or rapid identification methods. Furthermore, since no electrical charge or wires are required to ignite TATP, the "problem" of setting off metal detectors is avoided.

"There has never been a successful attack"

This refrain is heard often from those that feel this attention to liquid explosives is somewhat redundant. Critics point to the fact that Richard Reid’s shoe bomb failed and that the other plots were apprehended before they could be executed.

However, we know that terrorists will continue to use a modus operandi, adapting it if necessary, to accomplish their goals.

Given this situation, what can Law Enforcement do?
Look for the Bomber not the Bomb

At all SSI trainings we try to emphasize the point that terrorists are constantly adapting in this asymmetrical conflict. By concentrating our efforts on finding the bombers, we will automatically detect their constantly changing arsenal of weapons.

Without such an approach we are constantly at the disadvantage of the organized force trying to combat a guerilla tactic approach. Terrorist groups were nearly successful with liquid explosives in 1995. Despite this, for more than 10 years and certainly for 5 years after 9/11 there has been no significant effort to stop liquid explosives.

Only in a reactive mode, after August 10th, did the TSA institute controls on liquids brought aboard planes. Likewise, the shoe bomber Richard Reid, has caused each and everyone to remove his shoes. However, before his ill-fated attempt, no-one had to have their shoes checked. This means he could have succeeded if the bomb had not failed.

But terror groups are already designing new improvised weapons of destruction. Because we do not know what these are, they are impossible to detect. The next generation may be a simple aerosol that causes everyone in the plane to be neutralized and allow terrorists to take over the plane. We can not know what weapon they will choose.

However, we can know who they are if we use forms of behavior profiling that will lead us to couriers of destruction – and they may even be innocent of the fact they are carrying out a terrorist’s agenda – by the simple expedient of questioning such as is practiced in Israeli security systems and comparing answers and body languages to the principles of behavioral profiling. Unfortunately, this has become embroiled in the human rights aspect of Ethnic and Racial Profiling – neither of which can per se’ be effective against terrorists. Just as they change their weapons, they change their looks and their members racial and ethnic identities.

The best form of detection is prevention and finding terrorists before they can use their constantly changing arsenals of destruction.