IBIS - GunOps - ShotSpotter:

The Spears of the Trident

white paper

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Investigating and solving gun crimes with an advanced 3-pronged approach

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An ancient weapon, the trident is a three-pronged spear-head attached on the end of a long wooden shaft. It is a symbol first associated with Poseidon the Greek god of the sea world and savior of ships. He used his trident to cause tempests and earthquakes and then restore peacefulness. It has been said that with his Trident, Poseidon held a 3-fold power over heaven, the earth, and hell.

Hindus call the trident the trishul - a symbolic weapon against evil.

A Snapshot of 2016:

Recently, a study looked at data from Washington DC, and Oakland, California, and found that only 12% of gunfire incidents resulted in a 911 call to report gunshots.[1] This is a little more than 1 in every 10 shootings being reported by a potential witness, victim or concerned citizen.

How does that impact the public? Or the police who struggle with gun crime investigations?

When firearm crimes go unsolved, victims are denied liberty and justice, their families robbed of resolution and closure, and their neighborhoods forsaken peace and stability. Furthermore, the community's trust in the criminal justice system decreases while the demand for police and emergency services increases thereby impacting the cost and quality of these services. Entire communities soon become victims themselves to the economic costs associated with gun crime; businesses leave and jobs disappear, property values plummet and the tax base erodes.

When it comes to the identification and apprehension of criminals using firearms, the process is basically the same the world over: police must collect the pertinent pieces of information and evidence and establish the elements of the offense, which leads to the identification, arrest and prosecution of the responsible parties.

When guns are involved there are certain bits and pieces of evidence that investigators must always look for which originate from *inside* and *outside* the gun itself.

- From the **inside** of the gun comes data in the form of unique markings left on fired ammunition components by the internal working parts of the gun during the discharge

[1] Carr, J. B., and J. L. Doleac (2016): "The geography, incidence, and underreporting of gun violence: new evidence using ShotSpotter data". Paper, available at: http://www.brookings.edu/~/media/research/files/papers/2016/04/27-gun-violence-underreporting/carr_doleac_gunfire_underreporting.pdf

process - this is commonly referred to as “ballistics data”.

- From the **outside** - comes identifying data in the form of make, model, and serial number that can be used to track the transactional history of the gun. In addition, other valuable forensic data, such as DNA), latent fingerprints, and trace evidence (e.g. blood, hairs, fibers, etc.), which can help police identify a person associated with the gun can be found on the surface bearing areas of the firearm and ammunition components.

I refer to this as the *inside-out approach* in my book entitled: *The 13 Critical Tasks: An Inside-out Approach to Solving More Gun Crime.*

All Crimes Involving the Use of Firearms

I am often asked why I use the phrase “thoroughly and systematically investigate ALL crimes involving the use of firearms".

Experience has shown time and time again that even the seemingly insignificant shootings, like those without injury or the common “target practice on a street sign” can often provide the missing link – one of those key bits and pieces of evidence – to complete the puzzle and answer the basic questions “What happened and who done it?”

These days however, criminals are often on the move-scattering evidence across city, state and even national boundaries. Over and over it has been shown that even seemingly insignificant actions can provide the missing link to solving crimes. For example, a successful murder investigation in a metropolitan area could very well hinge upon the actions of a police officer in a rural town twenty miles away taking a weapon into custody during a routine motor vehicle stop. Therefore, a regional approach to the collection and management of all firearm-related evidence is often essential to a successful firearms investigation.

The International Association of Chiefs of Police (IACP) has officially encouraged the implementation of regionally applied firearm evidence handling protocols to facilitate necessary data sharing. In 2012, the IACP adopted resolution number FC.028.a12, page 51 and 52 entitled: *Regional Crime Gun Processing Protocols at its 119th Annual Conference in San Diego, CA*. The resolution encourages law enforcement officials, prosecuting attorneys and forensic experts to collaborate on the design of mutually-agreeable protocols best suited for their region.

The resolution identified six points which must be considered when drafting a protocol:

- The thorough investigation of each gun crime and the safe and proper collection of all crime guns and related evidence.
- The entry of appropriate NCIC transactions (e.g. stolen, recovered) on recovered guns.
- The timely and comprehensive tracing of all crime guns through ATF & eTrace.
- The timely processing of crime gun test fires and ballistics evidence through NIBIN.
- The timely lab submission and analysis of other forensic data from crime guns and related evidence (e.g. DNA, latent fingerprints, trace evidence).
- The timely generation, dissemination and investigative follow-up of the intelligence derived from the protocols.

Timeliness, as noted in the points above, is critical to these processes. The longer armed criminals remain free, the more opportunities they have to do more harm.

It takes sound policies to drive such protocols and diligent adherence to policies to sustain them.

In New Jersey, for example, the thorough and systematic investigation of crimes involving the use of firearms is a public policy priority driven top down by legislators and administrators across the state to police officers, forensic experts, and prosecuting attorneys.

In 2013, New Jersey enacted legislation[2] that made it the policy of the State for law enforcers to utilize certain systems when investigating crimes involving firearms:

a) the National Crime Information Center (NCIC) System to determine whether a firearm has been reported stolen;
b) the Bureau of Alcohol, Tobacco, Firearms, and Explosives "eTrace" System to identify the firearm's first purchaser and where and when it was purchased;
c) the National Integrated Ballistics Information Network (NIBIN) to determine whether a particular firearm is linked to another criminal event.

The New Jersey Attorney General and the Superintendent of the New Jersey State Police (NJSP) were given the responsibility to design the necessary protocols to implement the new statutes. Thinking and acting together with their law enforcement partners throughout the State they created a model program worthy of national attention.

The NJSP along with its local and federal partners have designed a sustainable program based upon *collaborative teamwork*, *innovative tactics* and *advanced technologies* which has enabled them to go beyond

[2] N.J. Rev. Stats. §C.52:17B-9.18; §C.52:17B-9.19; §C.52:17B-5.3

what the new law required and also embrace recommendations made by the International Association of Chiefs of Police (IACP).

In terms of *advanced technologies* aimed specifically at firearm related crime, three technologies are relied upon and leveraged in New Jersey:

1) **ShotSpotter™** – a real-time gunshot detection and location system
2) **GunOps™** - a web-based gun crime tracking system that facilitates investigations and collaboration.
3) the **Integrated Ballistics Identification System™** (IBIS) - the platform of the ATF National Integrated Ballistics Information Network (NIBIN) and,

These technologies can provide law enforcement authorities with real-time intelligence that offers tactical and strategic value and help solve gun crimes faster.

Tactical information in this context involves data generated over the short term which has immediate relevance and value to a particular event or series of events. For example, using internal ballistic data, a gun seized from a gang member can be linked through the ATF NIBIN network to one or more crimes. NIBIN can also be used to link two or more crimes in which the same firearm was used so that police can leverage the information known about each crime and generate new investigative leads.

Strategic information on the other hand involves data that is collected over the long term and used to identify patterns and trends. This data is for quantification and targeting purposes, informed decision-making and resource alignment. For example, ATF's eTrace system provides police with the ability to build a comprehensive database of crime gun trace data collected over time which can help identify the numbers and types of guns most commonly used in crime and their sources, as well as other recurring activity within the region's illegal firearm market. The pattern and trend analysis can then act as the driver for the development of new polices and tactics to respond to these threats.

Advanced Technologies in Play in New Jersey

What is ShotSpotter?

ShotSpotter is gunshot detection, acoustic surveillance technology that uses sophisticated sensors to detect, locate and alert law enforcement agencies of illegal gunfire incidents in real time. The technology detects when a gun is discharged, protects officers with increased tactical awareness, and connects law enforcement agencies to the community and to their mission of protect and serve. The real-time digital alerts include a precise location on a map (latitude/longitude) with corresponding meta data such as the address, latitude/longitude, speed of travel, direction of travel, number of stops fired and possible multiple shooters. delivered to any browser-enabled device or mobile device in 60 seconds or less.

Who uses ShotSpotter?

ShotSpotter is used in approximately 90 cities worldwide. It is highly regarded by law enforcement agencies as a critical component of their gun violence reduction strategy. ShotSpotter deployments include a diverse set of cities by size, geography and socioeconomic standards. Police departments are the typical core user of ShotSpotter, and the data has been shown to be valuable to prosecutors in court cases and city leadership for smart city initiatives.

How does ShotSpotter work?

ShotSpotter uses acoustic sensors that are strategically placed in an array of 15-20 sensors per square mile in order to detect and triangulate gunshot activity. Each sensor captures the precise time, location, and audio snippet associated with boom and bang sounds (impulsive noise) that may represent a gunshot. This data is first filtered by sophisticated machine algorithms that are then further qualified by an expertly trained and staffed 24x7 Support Operations Center at ShotSpotter to insure the events are in fact gunfire.

In addition, they can append the alert with any other critical intelligence such as whether a full automatic weapon was fired. This process takes less than 60 seconds between the actual shooting and the digital alert (with a precise location dot on a map) popping onto the screen of a computer in the 9-1-1 Communications Center.

Figure 1: ShotSpotter "Coverage Area"

How does ShotSpotter help address gun crime?

ShotSpotter will instantly notify officers of gunshot crimes in progress with real-time data delivered to dispatch centers, patrol cars and even smart phones. This enhances officer safety and effectiveness with critical intelligence such as: real-time access to maps of shooting locations and gunshot audio, actionable intelligence detailing the number of shooters and the number of shots fired, accurate and precise locations for first responders aiding victims, searching for evidence and interviewing witnesses.

With ShotSpotter, officers can arrive at the scene of a crime faster, and will have an increased level of safety knowing exactly where the crime is happening because the precise location of the shooting event has already been qualified. In many cases, an officer can arrive with the shooter still live on the

crime scene. Or, if the criminal has fled, shell casings can be recovered and used for investigative and potential prosecution purposes.

What is GunOps?

GunOps is a firearm-crime investigative tool used by police to help map firearm crime, search for trends and evidence, and hunt for suspects. It is web-based allowing for unlimited collaboration amongst law enforcement personnel. GunOps provides a visual and interactive way to monitor recovered firearm evidence as it is booked into the police department. This allows firearm examiners and investigators to filter and view firearm-related evidence according to geographical areas, which enables them to quickly zero in on the targets of interest. This is accomplished by connecting many pieces of information in order to link crimes, guns and suspects in a timelier manner so as to be of most value to investigators.

Who uses GunOps?

GunOps has been studied by academics and field-proven where the rubber meets the road – on America's streets; streets like those in Anaheim, Santa Ana, San Joaquin County, Stockton, South Bend, New Orleans, and across the State of New Jersey. As of this writing, the ATF and law enforcement agencies in Guatemala, Mexico, the Philippines, Trinidad & Tobago, the United Arab Emirates, and the United Kingdom, have also expressed interest in GunOps.

How does GunOps work?

GunOps is a web-based application accessed through any computer or hand-held device and lets users enter data on gun-related cases with ease. Investigators can then readily search for and visualize the relationships between cases in terms of time, proximity, and firearm evidence characteristics. GunOps has a powerful, yet clean architecture which manages a large volume of firearms crime data and is completely searchable making it the ultimate time saver. GunOps uses a highly intuitive and interactive GUI that makes it easy to learn and seamlessly incorporate into the daily routines of investigators and analysts.

How does GunOps help address gun crime?

A big challenge for criminal investigators today isn't always a lack of information. A big challenge is being able to spot the relevant pieces of high value data, cross-reference them for additional leverage and convert them into solid blocks of actionable intelligence in a timely manner. GunOps allows users to manage all of the relevant bits and pieces of information at their fingertips. Empowered at their own workstation or in the field on a mobile device, detectives can just click to connect the various bits and pieces of data and uncover the evidence needed in a fast and sustainable way. The intuitive mapping functions allows detectives, command staff, firearm examiners and intelligence analysts to work simultaneously mapping gun-related incidents and readily visualizing the relationships between them in terms of time, proximity, and firearm evidence characteristics.

What is IBIS?

IBIS® (Integrated Ballistic Identification System), an integrated technology solution consisting of hardware and software which enables the sharing and comparison of significant quantities of exhibit information and images across a network of imaging sites, as well as the automated identification of likely matching bullets or

cartridge cases. IBIS TRAX-HD3D is the latest generation of IBIS technology and includes exceptional 3D imaging, advanced comparison algorithms, and a robust infrastructure.

Who uses IBIS?

IBIS is the backbone of the world's firearm forensic laboratories, serving thousands of law enforcement agencies, big and small, through services provided by hundreds of law enforcement organizations located in nearly 70 countries and territories. More than 500 IBIS stations have been deployed to date. IBIS data is relied upon by detectives to identify and apprehend criminals who use firearms to kill and injure and by prosecutors to bring these criminals to justice and convict them.

How does IBIS work?

IBIS captures digital images of the unique markings left on fired bullets and cartridge cases by the internal working parts of a firearm during the discharge process. A unique “electronic signature” is extracted from the digital images then stored in a database. As each signature is acquired and stored the system compares it against the others in the database with lightning speed to determine if there is a potential match indicating that the pair was fired from the same gun. Each pair is given a score and ranked in order of the highest likelihood of a match. IBIS networks like NIBIN can share critical data quickly across jurisdictions.

How does IBIS help address gun crime?

IBIS can help police and forensic specialists connect firearms to crimes; for example, a firearm that has been seized for cause during a routine car stop to a murder or series of prior murders. Furthermore, fired bullets and cartridge cases collected at one crime scene can be linked to another or a series of previous crimes. The police can then combine and leverage the pieces of information known about each crime. With more ‘pieces of the puzzle’ in hand, police can see a clearer picture of what transpired, helping them find a suspect more quickly. IBIS has been carefully studied for decades by researchers around the world and has proven to be a valuable tool in helping solve gun-related crimes, particularly crimes lacking suspects or leads. When networked, these systems enable the quick searching of multiple ballistic databases across local, regional, and international jurisdictions, helping to produce leads that would have otherwise remained undetected and the cases unsolved.

The Tactical and Strategic uses of these three technologies:

ShotSpotter®	GUNOPS CLOUD-BASED CRIME-TRACKING SYSTEM	IBIS TRAX HD3D
ShotSpotter is used tactically to detect illegal gunfire accurately, protect officers with increased tactical awareness and connect police to the community while also connecting police to their mission. ShotSpotter intelligence can also be used to communicate and solve crimes faster in addition to increasing prosecutions and arrests. ShotSpotter is used strategically to visualize "hot spots" of gunfire activity and analyze illegal gunfire incidents occurring over a period of time in order to identify and visualize patterns and trends in gunfire activity in terms of frequency, location, time and amount of shots fired.	GunOps is used tactically to search for, prioritize and visualize the relationships within and between. GunOps is used strategically to identify and visualize "hotspots" of firearm crimes and cases occurring over time including recovered guns and evidence and analyze and quantify the wide range of detailed case related data contained in the many data fields the systems manages to discern patterns and trends.	IBIS is used tactically to link crimes, guns and suspects. IBIS is used strategically to discern patterns and trends between the crimes, guns and suspects from data collected over time in order to identify and quantify types and calibers of guns and fired ammunition, and find associations between cases and the criminal groups involved.

Using the Trident to Trap Armed Criminals: How New Jersey has Leveraged the Three Technologies

In New Jersey, ShotSpotter technology is used by seven law enforcement agencies the: Atlantic City Police Department, Camden County Police Department, East Orange Police Department, Newark Police Department, Paterson Police Department, Plainfield Police Department and Trenton Police Department. ShotSpotter has "electronically fenced" certain areas within in those cities as contracted coverage areas designated for gun-shot detection monitoring. A ShotSpotter alert to a gunfire incident is designed to trigger a rapid police response which could lead to the identification of a shooter, assist in locating witnesses, get emergency services to the scene faster and allow for the collection of ballistics evidence critical to leveraging the gun crime intelligence advantages of NIBIN, for example, in terms of connecting crimes, guns and suspects.

For example, a ShotSpotter alert enabled police to quickly respond to a gunfire incident on Walnut Avenue in Trenton and arrest the shooter.[3] In Atlantic City, a ShotSpotter alert to a gunfire incident set a series of actions in motion which led Atlantic City police to recover four guns — including one reported stolen from South Carolina — and an arrest warrant for a woman believed to be the shooter.[4] Sometimes, ShotSpotter is the witness – for example a woman in Savannah called 911, reporting her 6-year-old daughter had been shot while they were walking to school. A ShotSpotter alert, told a different version of the story. The shooting really occurred blocks away in the woman's apartment. The woman and her boyfriend were both charged with crimes related to the incident, which began as a domestic dispute, and the child was treated at a hospital.[5]

Before ShotSpotter, police in those cities had to rely mostly on 911 calls to respond which statistics have shown only occurred about 12 percent of the time. Police were left blind – unaware of where the overwhelming majority of gunfire incidents occurred within certain areas of the city. As a result, opportunities were missed to apprehend suspects, locate witnesses, collect ballistics evidence and possibly save lives.

In New Jersey there are IBIS systems connected to the NIBIN network located at eight law enforcement agencies across the State: Bergen County Sheriff's Department, Camden County Police Department, Essex County Sheriff's Department, Newark Police Department, New Jersey State Police, Ocean County Sheriff's Department, Somerset County Prosecutor's Office and Union County Police Department.

Fired ammunition components like cartridges cases collected as evidence from crimes scenes involving gunfire incidents and test-fires from suspected crime guns taken into police custody must be submitted to one of these eight sites for NIBIN processing.

IBIS sites located within a city police department generally provide NIBIN services for that agency alone unless agreements have been made to accept submissions from certain other agencies. For example, Newark PD accepts submissions from several nearby agencies. IBIS sites located in county agencies generally accept submissions from the law enforcement agencies located within those counties. The IBIS site located at the New Jersey State Police Lab in Hamilton provides NIBIN services for the rest of the approximately 550 law enforcement agencies across the State[6] not served by a city or county IBIS site.

The increased percentages of ballistics evidence that ShotSpotter facilitates in Atlantic City, Paterson and Trenton are processed through NIBIN by the State Police who have put innovative programs in place making it easier and much faster for law enforcement agencies in the northern and southern areas of the State to submit their fired evidence and seized guns for processing. The Camden Police Department has its own IBIS system and Plainfield (Union County) submits to the Union County PD for NIBIN processing.

[3] http://www.nj.com/mercer/index.ssf/2015/05/trenton_redeploys_shotspotter_system_in_larger_are.html
[4] http://www.pressofatlanticcity.com/news/crime/shots-fired-call-leads-to-recovery-of-four-handguns-and/article_ab400096-54c0-11e4-a6bf-1b12aa54e895.html
[5] http://www.shotspotter.com/news/article/metro-police-atf-partner-to-curb-savannah-violence-illegal-guns
[6] http://www.bjs.gov/content/pub/pdf/csllea08.pdf

The NIBIN network allows law enforcement personnel to search the IBIS data within the greater New Jersey Region and beyond, across the entire national NIBIN network.

In June of 2014, a 19-year-old college student stopped at a red light late one night in West Orange, New Jersey. A man approached and shot the student multiple times killing him. Fired cartridge case evidence was collected from the scene, and brought to the crime lab where key data was extracted and searched through NIBIN. The NIBIN check pointed police to a connection between the murder in West Orange and three others in Seattle, Washington several weeks earlier. Seattle Police had identified a suspect and were trying to locate him. Police in New Jersey, picked up the suspect's trail from additional violent crimes which were occurring in the area and found the suspect living in a wooded area not far from where the student was murdered. The suspect told police that he killed to express his anger at U.S. Government actions in the Middle East.

The New Jersey State Police have acquired GunOps to link the states eight NIBIN sites making up the New Jersey Ballistics Community of Interest as a first step toward more comprehensive data collection `statewide.

GunOps allows the New Jersey Ballistics Labs to input a wide variety of relevant data about the cases that are submitted to them. This data comes directly from the police reports they receive and is the comprehensive case management leg of the Trident system between ShotSpotter, GunOps and NIBIN. Forensic and investigative personnel from the eight agencies with access to GunOps labs are able to access and query this large pool of data to find hidden relationships beyond ballistics data alone.

For example, GunOps captures a wide variety data specifically relevant to conduct firearm related investigations – information such as: the names of victims, witnesses and suspects, descriptions of recovered guns and ammunition and ballistics matches that have been identified and more. A NJSP intelligence analyst utilizing GunOps was able to link nine cases solely through name searches and ballistics reports. The analyst started by conducting a name search through GunOps on both the victim and the shooter involved in an aggravated assault that occurred in Atlantic City. That check revealed that the victim was also a suspect in a homicide that had occurred in a nearby city. Checks on the shooter's name led to more connections and records indicating past ballistics matches added still more information to link nine investigations not previously known to be connected. This 3-pronged approach is precisely what agency's need to combat illegal gunfire and solve related crimes.

Taking New Jersey to an Even Higher Level of Gun Crime Intelligence

ShotSpotter, GunOps and IBIS are similar to the three spears of a trident — individually, they can do harm, but used as one they are devastating!

New Jersey perhaps stands alone in terms of having innovative statewide policies and laws in place to ensure the thorough investigation of *all* gun related crimes and the comprehensive collection and management gun crime data and intelligence.

The NJSP along with its local and federal partners have designed model programs based upon collaborative teamwork, innovative tactics and advanced technologies which has enabled them to go beyond what their groundbreaking new law required. Moreover, they also embraced the recommendations made by the International Association of Chiefs of Police (IACP).

Consider this:

- **Eight (8) law enforcement agencies** in New Jersey possess IBIS technology and are entry points to the NIBIN network. They are also authorized, through licenses obtained by the NJSP, to use GunOps.
- ShotSpotter is being utilized **by seven (7) law enforcement agencies** in New Jersey all of which contribute to NIBIN through their own proprietary IBIS system or through an IBIS system at one of the eight hubs.
- According to the Census of State and Local Law Enforcement Agencies, 2008, by the Bureau of Justice Statistics[7] **there are five hundred and fifty law enforcement agencies in New Jersey**.

The challenge of taking crime gun intelligence to a higher level should be obvious looking at the numbers above. In taking up the challenge, a multi-pronged strategy needs to be designed that ensures that any solutions proposed be sustainable.

Sustainability will require a balance of teamwork, tactics *and* technology.

The technology component of this solution will depend upon an analysis of key factors relating to: procurement and cost, number of sites, installation and operating requirements.

A key factor whenever dealing with repetitive acts of gun violence is timeliness. In this case, it will be the speed at which the improvements can be brought online in order to raise "crime gun intelligence quotient" for a much larger percentage of New Jersey's law enforcement community.

[7] http://www.bjs.gov/content/pub/pdf/csllea08.pdf

Summary

It is our duty to do everything we can do to help stop the spread of gun violence. The police, the public, and our very communities hang in the balance. By adopting new strategies, protocols and standards and applying them to our jurisdictions, we can all make a difference and stop shooters before they have time to do more harm.

By integrating ShotSpotter to help police detect gunfire, departments not only gain new information, but are able to collect additional evidence while the case is opened. In turn, GunOps helps capture all this additional case information before the firearm evidence is imaged in IBIS and stored in NIBIN.

Not only do each of these technologies bring value to investigators, but they benefit each other as well. One needs not look further than the example set by the New Jersey State Police. Because of ShotSpotter, the crimes and evidence that would otherwise go unnoticed is now able to be collected and analyzed using GunOps and IBIS. The crime scene and forensic data compiled and presented by GunOps is of great value to investigators in terms of intelligence and firearm examiners as they are able to prioritize evidence analysis. The links and leads provided by IBIS drive investigations and arrests and provide strategic value to departments and communities.

As Poseidon used the three barbed tines of his Trident to shake the world and then restore peacefulness, so too can IBIS, GunOps and ShotSpotter be used to rattle the underworld of gun violence and restore peace to our neighborhoods.

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