Todd Lizotte – Coinventor of Intentional Firearm Microstamping

TACLABS appreciate the opportunity to provide technical input regarding the viability of microstamping technology in semi-automatic handguns. As technologists specializing in forensic ballistics and firearm traceability, we recognize that microstamping is not a new or unproven concept. For over a century, firearms have been unintentionally microstamping cartridge casings during discharge, a phenomenon we refer to as Unintentional Firearm Microstamping (UFM).

Historical Precedent: The Foundation of Forensic Firearm Analysis

For more than 100 years, forensic experts have relied on UFM to analyze firearms recovered from crime scenes. Every fired cartridge carries a unique imprint left by imperfections in the firearm's manufacturing and usage history—burrs, scratches, and other surface irregularities. These marks are systematically analyzed through the National Integrated Ballistic Information Network (NIBIN), forming the core of forensic firearm trace analysis. The ability to extract ballistic signatures from spent casings has been an essential tool for law enforcement in identifying patterns, linking firearms to criminal activity, and tracing firearm trafficking routes, as long as the firearms are recovered. IFM provides further reliability by enhanced extraction, simply integrating 1 to 4 cartridges found at a crime scene, the probability of identifying the firearm approaches >96%.

Harnessing Proven Science: From UFM to IFM

TACLABS builds upon this century-old forensic method by deliberately engineering a more consistent and structured approach to microstamping—Intentional Firearm Microstamping (IFM). Rather than relying on random manufacturing defects to leave marks on cartridge casings, IFM integrates well-defined alphanumeric and geometric codes into firearm components, such as the firing pin or breech face, to ensure that every discharged cartridge carries an identifiable imprint.

This technological refinement utilizes established principles of physics and mechanics, alongside modern advancements in microscopy, AI-enhanced imaging, and high-resolution forensic analysis. Similar to how license plates on vehicles are identified through imaging technologies, microstamped firearm markings can be extracted with simple optical methods, ensuring rapid and reliable identification.

Reliability: A More Effective Forensic Tool

The reliability of IFM is straightforward when compared to the historical precedent of UFM. Traditional UFM provides forensic evidence only when a firearm is recovered, requiring investigators to match markings to known weapons. IFM, on the other hand, allows forensic experts to identify firearms directly from spent casings—even without recovering the firearm itself.

This significantly enhances the ability of law enforcement agencies to generate patterns to track firearm trafficking and illegal sales. IFM provides structured, intentional data points that integrate seamlessly into existing

forensic workflows and programs such as CompStat, offering a more reliable means of identifying firearms linked to criminal activity. The ability to extract full or partial alphanumeric codes from recovered casings adds another layer of forensic intelligence, improving the probability of linking firearms to specific sources—including straw purchases, theft rings, and rogue firearm dealers.

Conclusion: The Industry's Role in Advancing Firearm Forensics

The debate over reliability should not be about whether microstamping works—it already has, informally, for over a century. Instead, the focus should be on whether the firearm industry is willing to take the lead in modernizing forensic analysis to combat firearm trafficking. IFM simply refines an existing forensic tool, turning a century of unintentional microstamping into a proactive, structured methodology that enhances crime scene investigations and public safety.

We urge state officials to act swiftly in affirming the general viability of IFM, establishing initial performance standards, allowing the industry to start with a single surface to reduce their perceived cost limitations and implementing this technology to ensure California is prepared for the upcoming mandate that all semi-automatic handguns sold include microstamping capability.

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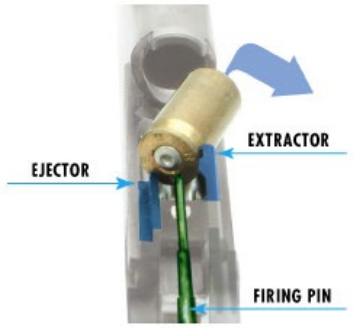
Intentional Firearm Microstamping

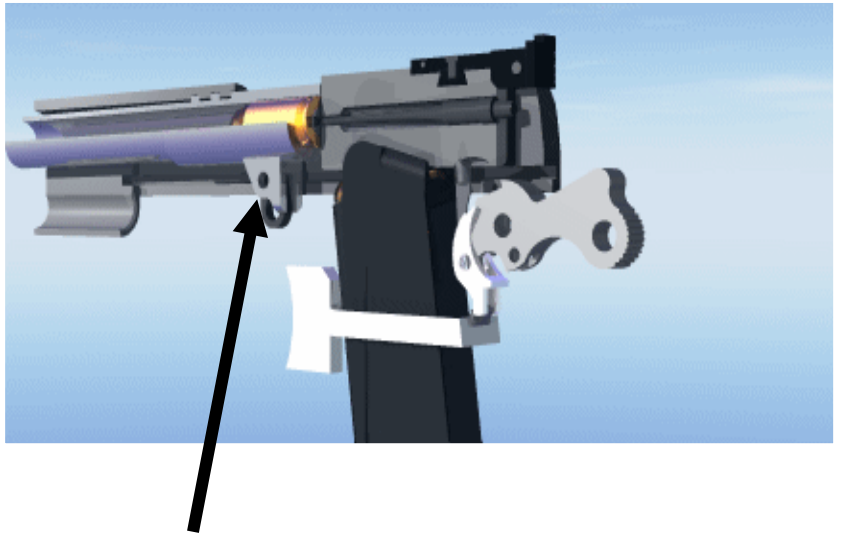
Combating Firearms Trafficking

Local, National and International

What is Intentional Firearm Microstamping (IFM™)?

IFM technology creates alphanumeric and geometric code elements within firearms, that stamp a cartridge casing with a code when fired. The ejected cartridge will identify the firearm without having to recover the firearm.





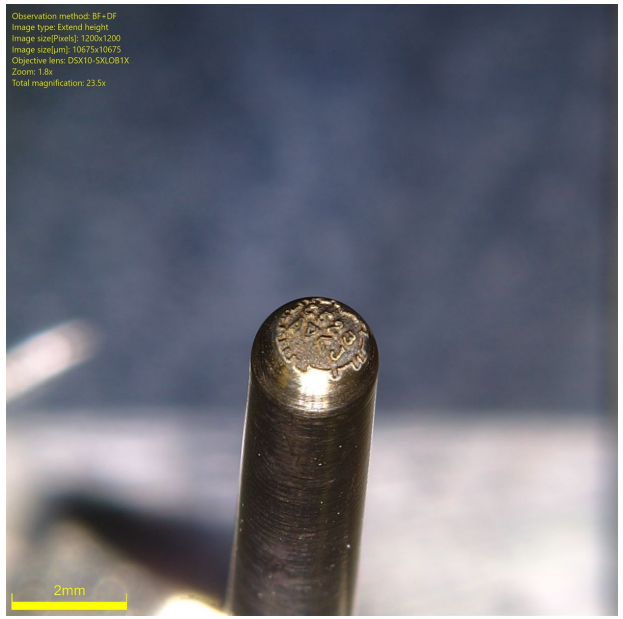
Firearm Cycles & Ejects

What is Intentional Firearm Microstamping (IFM™)?

TACLABS has developed a methodology which balances process know-how, materials interaction, microstructure geometry with lifecycle work hardening.

Within semiautomatic firearms small code structures are placed that can withstand the mechanical forces and chemical environment that is generated during the ignition of the cartridge primer to the main discharge propelling the projectile out the barrel.

With over 28 years of development and lifecycle testing, the TACLABS IFM process is robust and durable.



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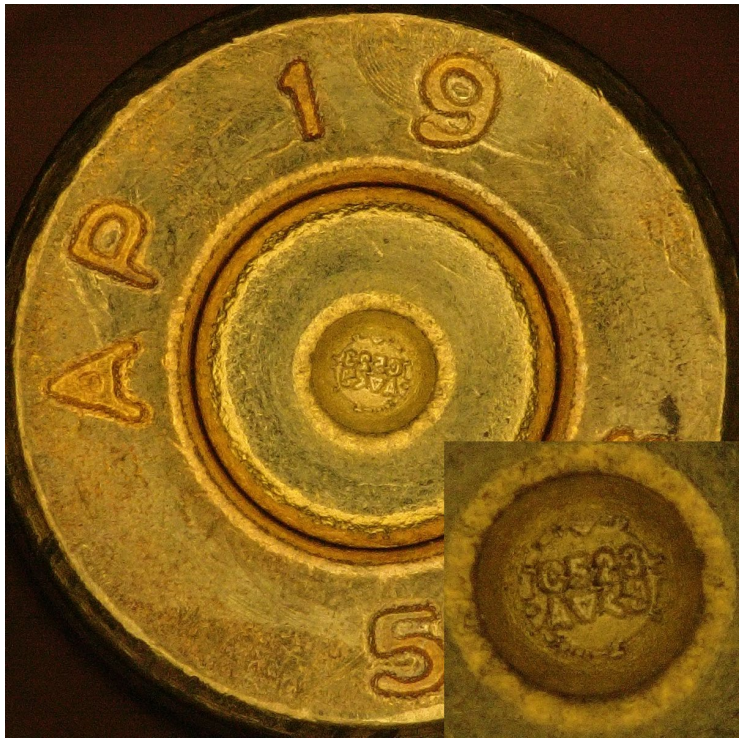
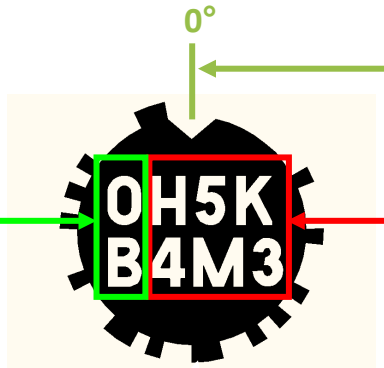
What is Intentional Firearm Microstamping (IFM™)?

The Power of The IFM Code

Optimized Code Geometry

What can be extracted from the code?





Notch Position (12° CW)
Year of issue date
& Orientation

Manufacturers
Alpha Code
"Makers Mark"

Index Code
Alpha Numeric
(Randomly generated &
Not sequentially issued)

IFM Code acts as a license plate to identify the firearm when cartridges are found at a crime scene or military exchange/engagement.

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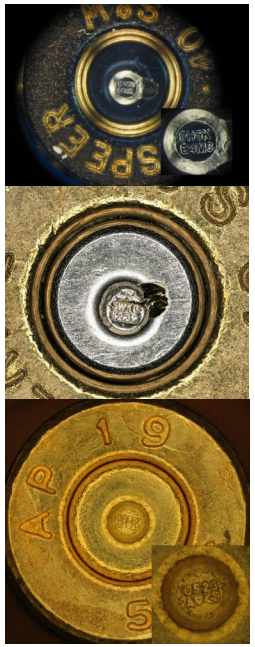
What is Intentional Firearm Microstamping (IFM™)?

Microstamping: Tested / Continuously Improved

Microstamping Process Enhancement & Lifetime Testing:

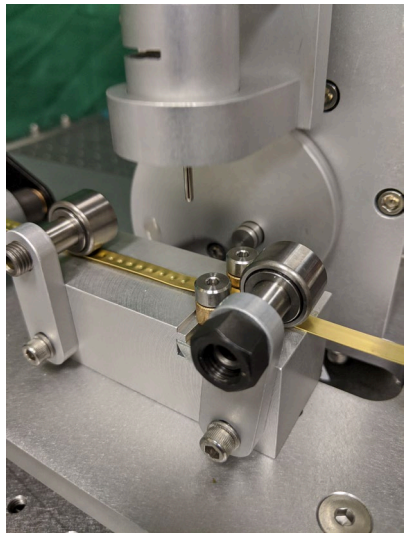
- Microstamping test program, features a new firearm model every six months
- TACLABS developed an accelerated lifetime test apparatus for firing pins (~50,000 Cycles/Pin)
- TACLABS tests a variety of ammunitions with varying primer and casing hardness and materials



Marking Transfer
Circa 2000-2005
(8 Digit Code)

Marking Transfer
Circa 2008-2018
(8 Digit Code / Gear Code)

Marking Transfer
Circa 2020
(8 Digit / Gear Code / Embedded Notch / Check Sum Redundancy)
AR-15 Program



Firing Pin Microstamp Lifetime Testing

- 50,000 Cycles
- Cartridge Primer Brass Strips
- 1 cycle/second Rate
- Military Level Testing

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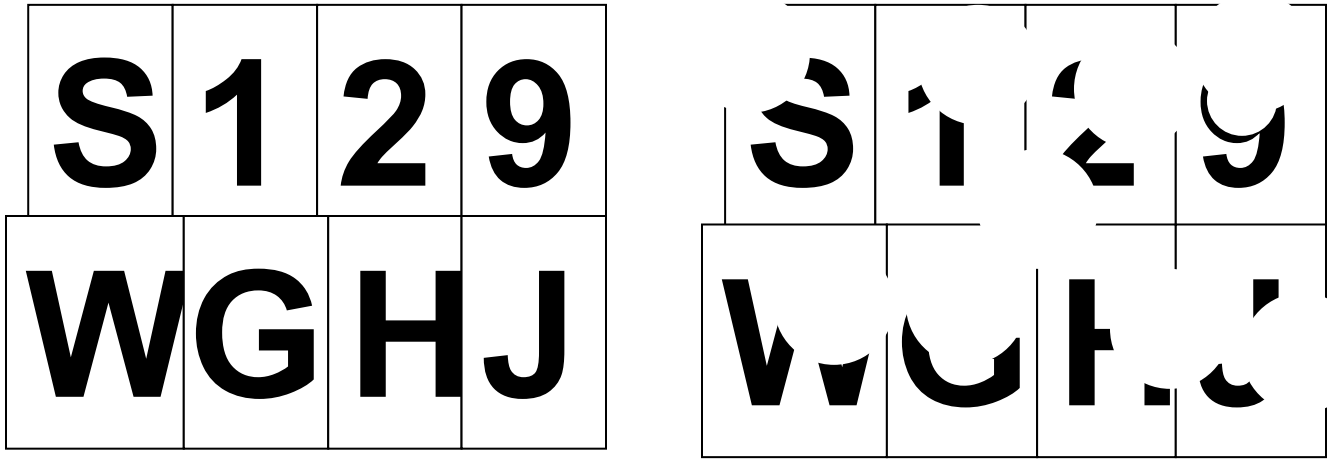
What is Intentional Firearm Microstamping (IFM™)?

The Power of The IFM Code

Microstamping: **Heuristic Algorithm Code Extraction Method**

Optimized to Firearm, Fixed Font, and Standardized Placement
"Yields High Degree of Extraction Capability"



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IFM™ Extracting/ Mapping Information

Leveraging Existing Forensic Infrastructure

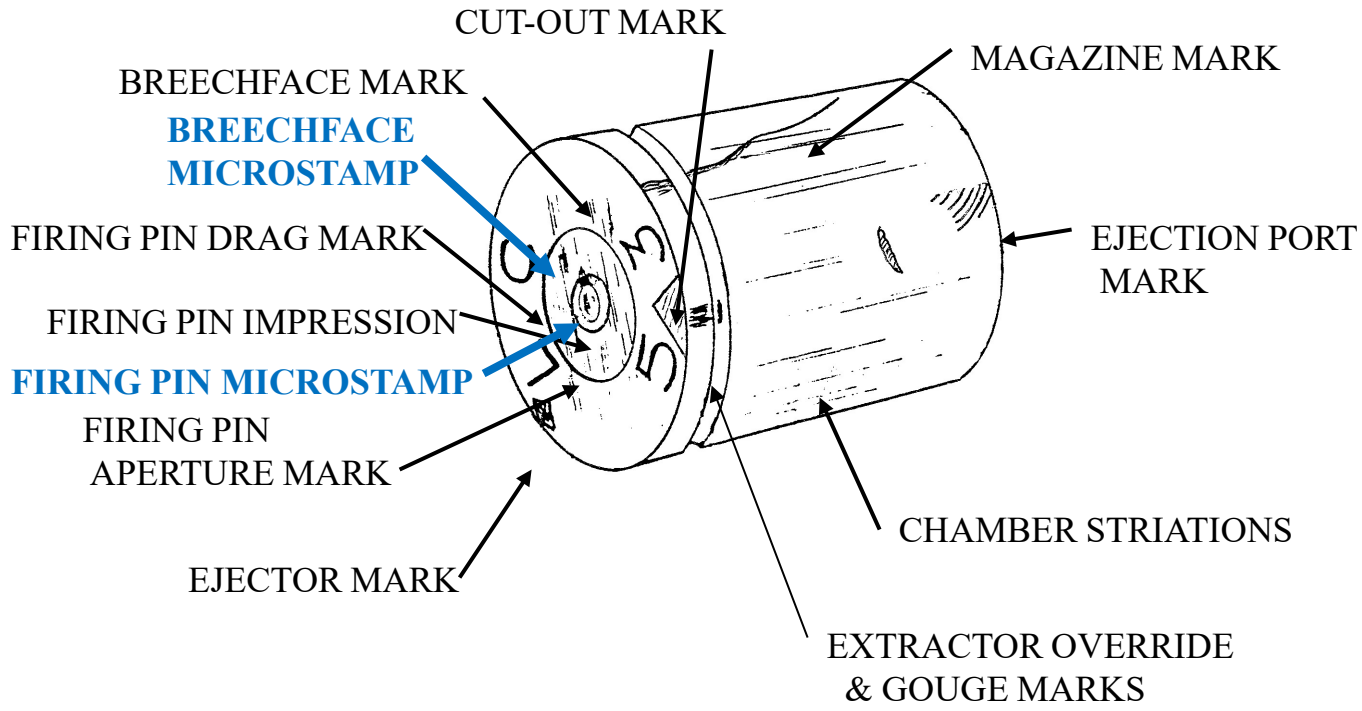
Examiner

Extraction Methods

- **Tool Mark Analysis**
  - Unique geometric line attributes
  - Curves, linear marks, etc
- **Cycle of Fire Analysis**
  - Identify unique tool markings representative of a specific firearm mechanism type
- **Observation Code Extraction**
  - Read the letters and number directly
  - Redundant Encoded Geometrics
- **Heuristic Analysis**
  - Match Characters and Numbers to known geometric attributes of the code design.
- **Multi-Cartridge Code Integration**
  - Two or more cartridge code integration
- **Code Index Analysis**
  - Code History based on visible characters (Code Characteristics)

MARKS LEFT ON EXPENDED CARTRIDGE CASINGS

(cycle of fire marks & **microstamping marks**)



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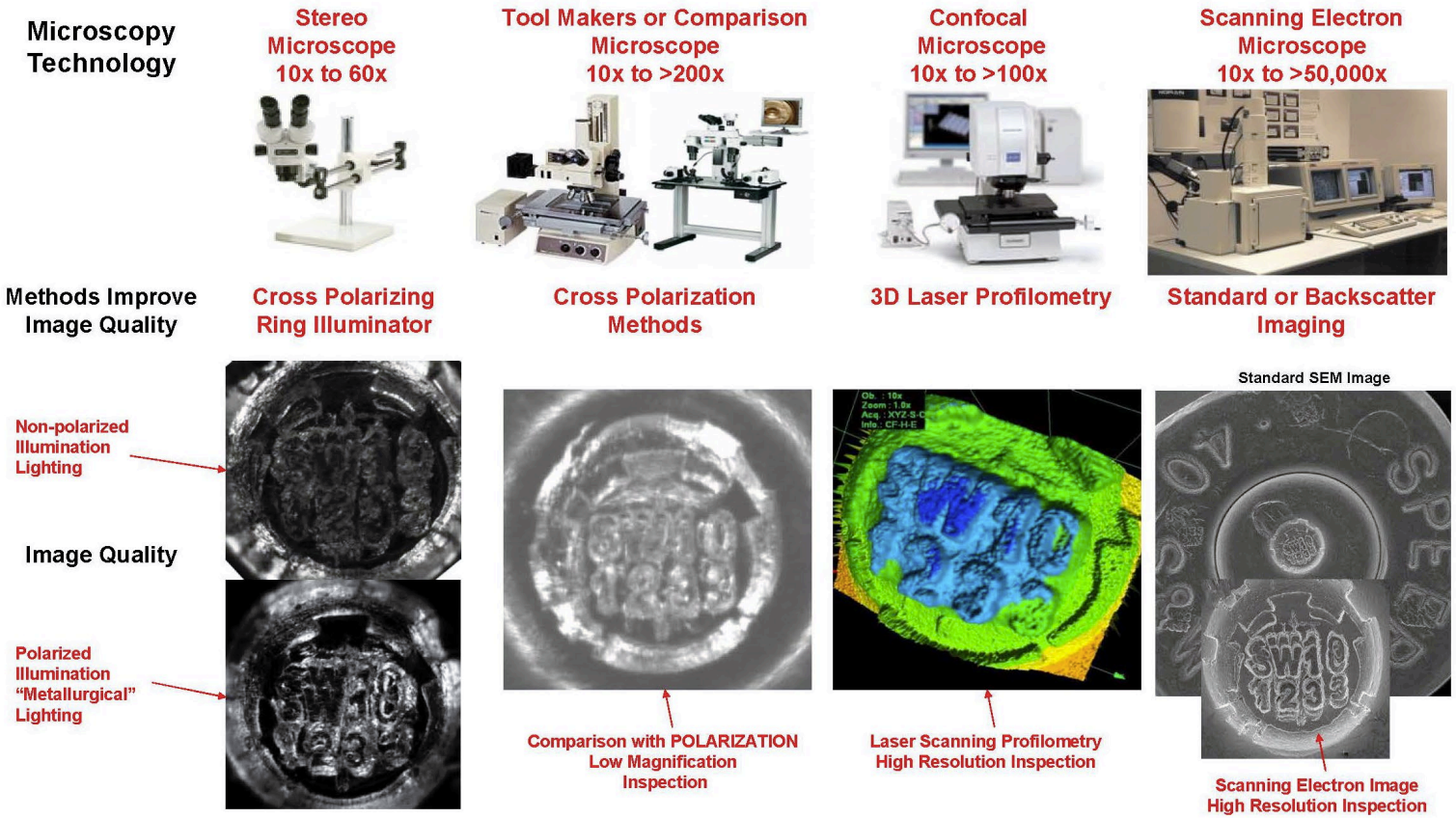
IFM™ Extracting/ Mapping Information

Leveraging Existing Forensic Infrastructure

Microstamp Microscopy : Extracting Data Efficiently



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Lizotte-Ohar Partial Code Extraction Method

1.0 for each character that can be read with absolute certainty.

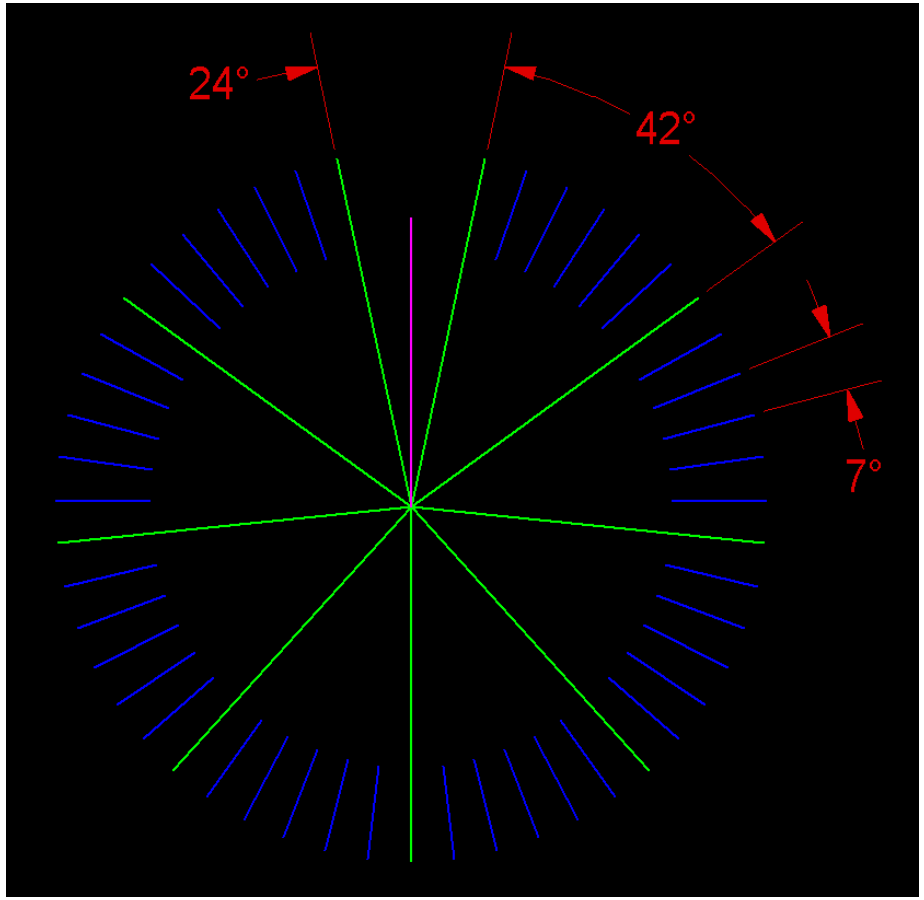
.75 for each damaged character that has enough information to identify it as one unique character.

.50 for damaged characters that might represent two or three possible outcomes.

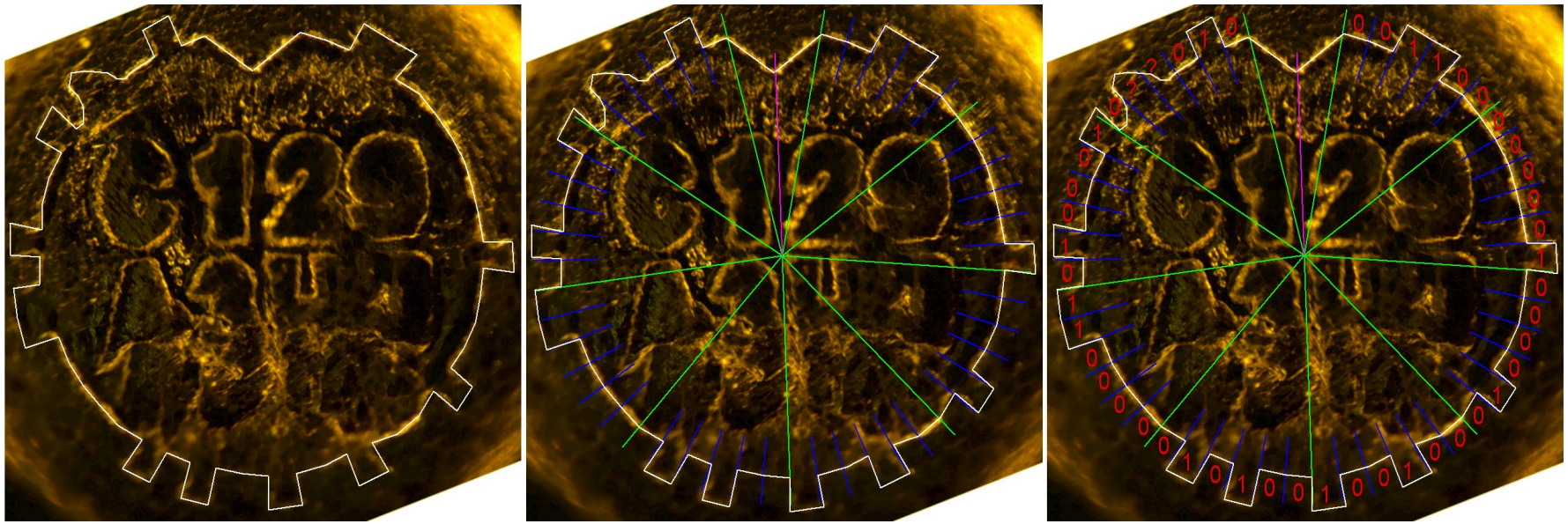
.25 for wiped out characters that appear to have some intact structure.

0 for completely wiped out characters

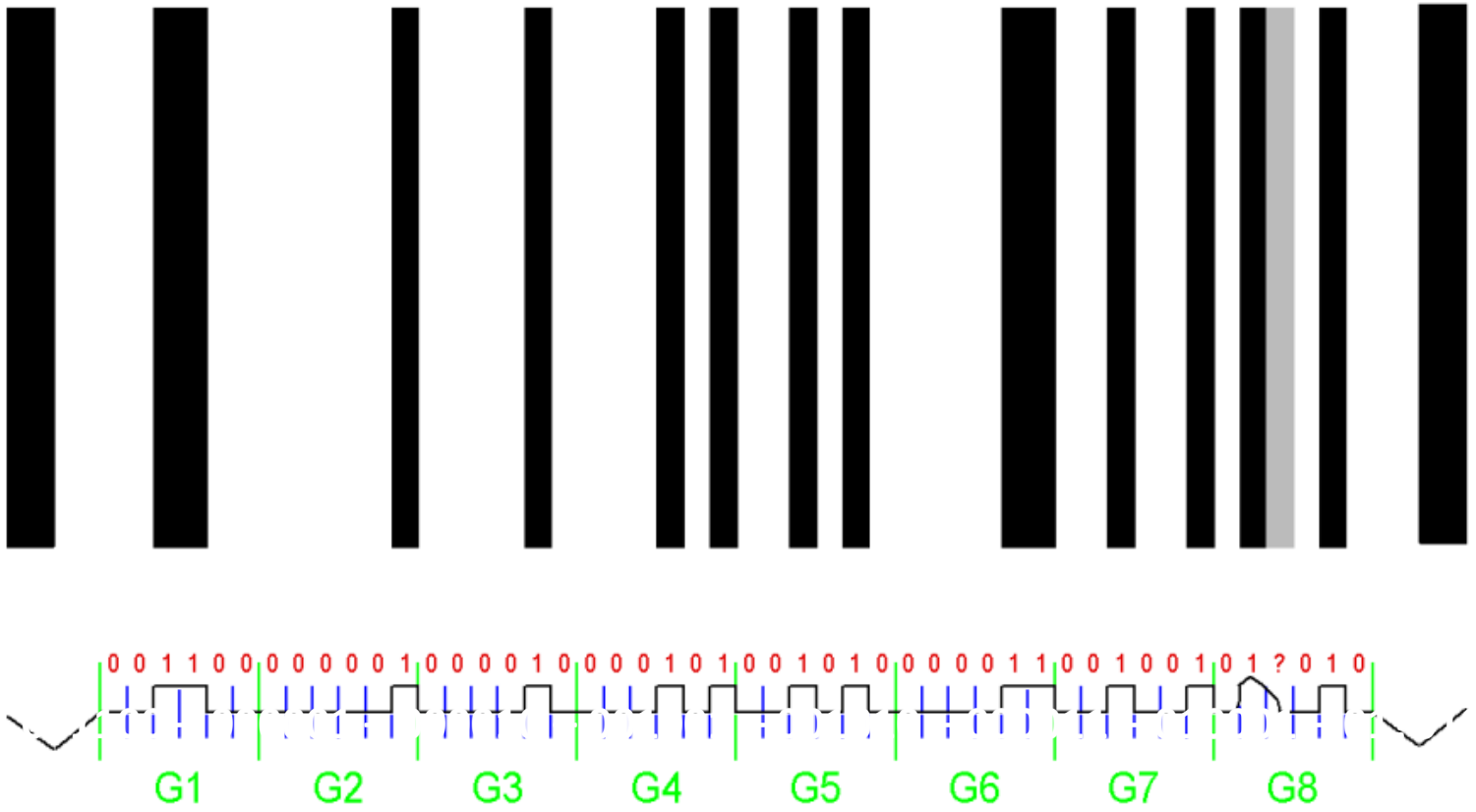
Gear Code Extraction



Off the shelf software

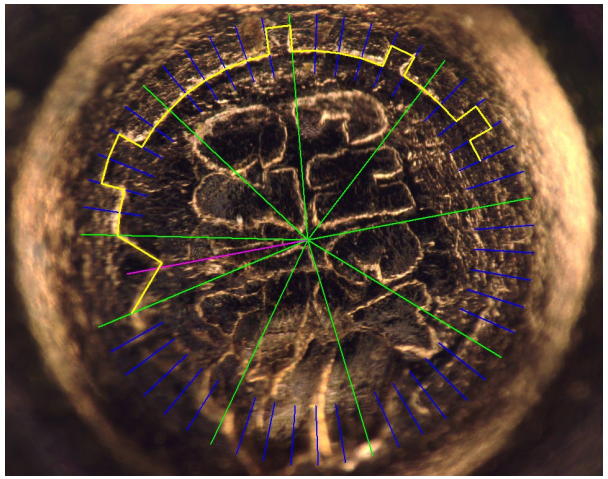


Read like a bar code…



Code Redundancy

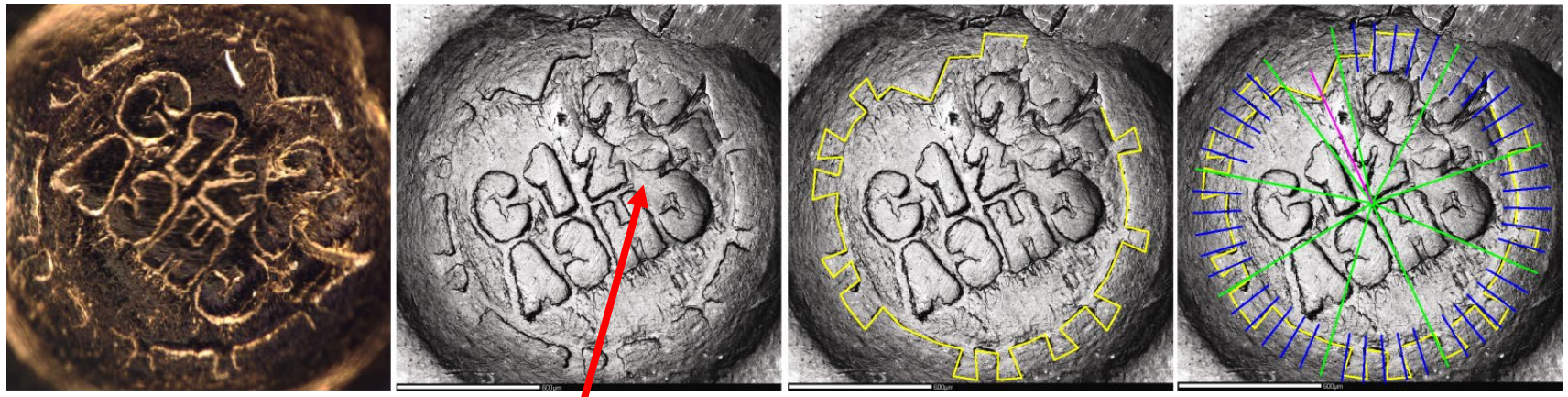
Combining and confirming codes increases certainty



.45 APC test fired: June 25, 2008		Alphanumeric Code									Gear Code									Combi Score
		C1	C2	C3	C4	C5	C6	C7	C8	AC o/a	G1	G2	G3	G4	G5	G6	G7	G8	GC o/a	
371	ID Score	0	.5	.5	.75	1	1	1	1	.72	1	1	1	.5	0	0	0	0	.53	0.97
	Extract Code	?	?	?	9	A	3	H	J		C	1	2	?	?	?	?	?		C129A3HJ

IFM™ Extracting/ Mapping Information

Extracting Data:
Multi-Strike & Pin Drag



.45 APC test June 25, 2008		Alphanumeric Code									Gear Code									
		C 1	C 2	C3	C4	C 5	C 6	C 7	C 8	C ave	G1	G2	G 3	G 4	G 5	G 6	G 7	G 8	G ave	Combi Score
841 SEM	ID Score	1	1	.75	.5	1	1	1	1	.88	.25	.25	1	1	1	1	1	1	.81	1.0
	Extract Code	C	1	2	?	A	3	H	J		?	?	2	9	A	3	H	J		C129 A3HJ
841 Optical	ID Score	1	1	.75	.50	1	1	1	1	.84	0	0	1	1	1	1	1	.75	.72	1.0
	Extract Code	C	1	2	?	A	3	H	J		?	?	2	9	A	3	H	J		C129 A3HJ

Test fire #841 Optical on the left, Back-Scatter SEM to the right with software enhanced extraction (100% Extraction)

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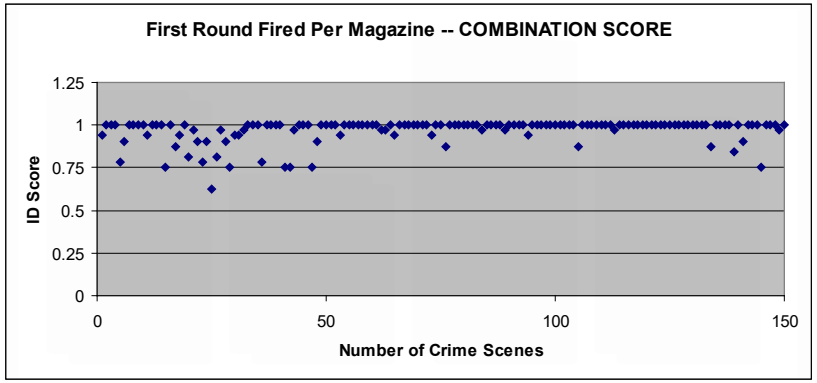
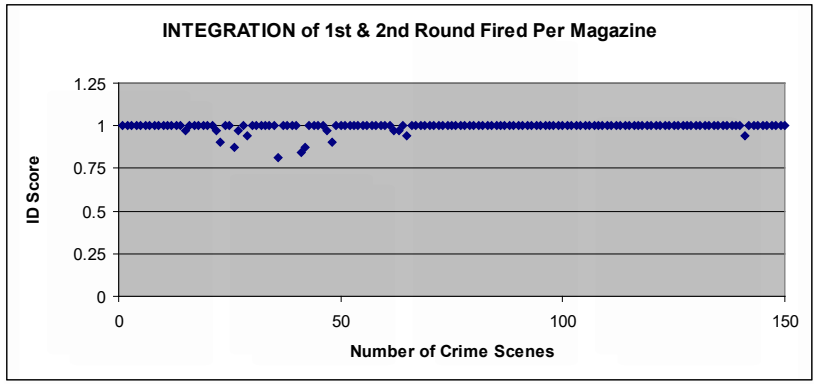
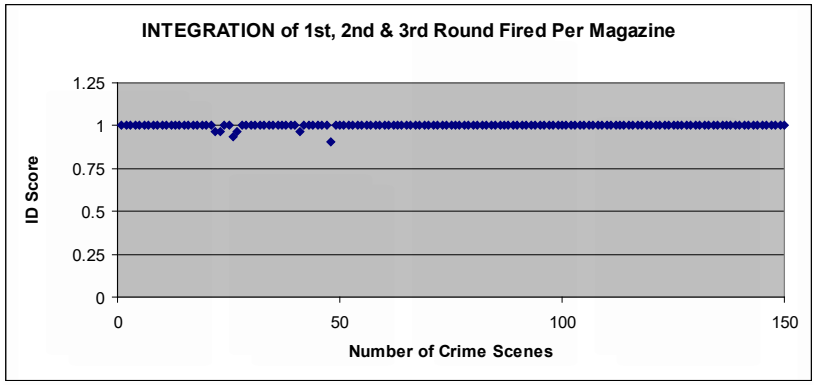
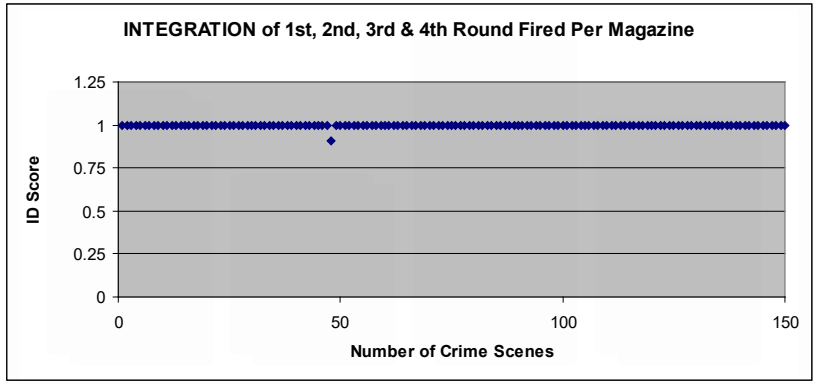
IFM™ Extracting/ Mapping Information

Integration Scatter Chart (>2 Cartridges Found, 99% Identification)









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IFM™ Extracting/ Mapping Information

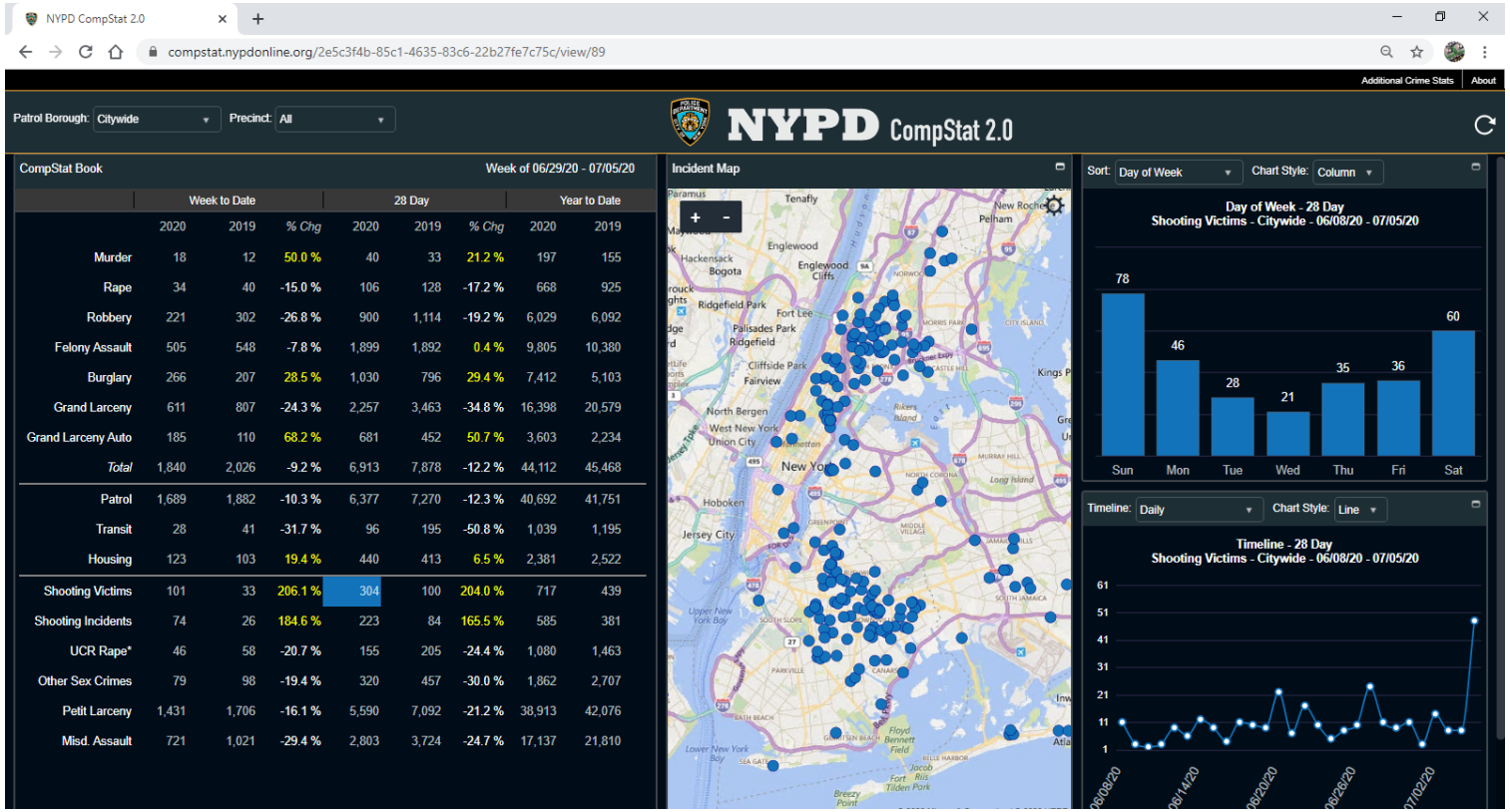
Increased Data

More Information

Increased Knowledge

Actionable Intelligence

IFM Targets Firearms Trafficking



	Week to Date			28 Day			Year to Date	
	2020	2019	% Chg	2020	2019	% Chg	2020	2019
Murder	18	12	50.0 %	40	33	21.2 %	197	155
Rape	34	40	-15.0 %	106	128	-17.2 %	668	925
Robbery	221	302	-26.8 %	900	1,114	-19.2 %	6,029	6,092
Felony Assault	505	548	-7.8 %	1,899	1,892	0.4 %	9,805	10,380
Burglary	266	207	28.5 %	1,030	796	29.4 %	7,412	5,103
Grand Larceny	611	807	-24.3 %	2,257	3,463	-34.8 %	16,398	20,579
Grand Larceny Auto	185	110	68.2 %	681	452	50.7 %	3,603	2,234
Total	1,840	2,026	-9.2 %	6,913	7,878	-12.2 %	44,112	45,468
Patrol	1,689	1,882	-10.3 %	6,377	7,270	-12.3 %	40,692	41,751
Transit	28	41	-31.7 %	96	195	-50.8 %	1,039	1,195
Housing	123	103	19.4 %	440	413	6.5 %	2,381	2,522
Shooting Victims	101	33	206.1 %	304	100	204.0 %	717	439
Shooting Incidents	74	26	184.6 %	223	84	165.5 %	585	381
UCR Rape*	46	58	-20.7 %	155	205	-24.4 %	1,080	1,463
Other Sex Crimes	79	98	-19.4 %	320	457	-30.0 %	1,862	2,707
Petit Larceny	1,431	1,706	-16.1 %	5,590	7,092	-21.2 %	38,913	42,076
Misd. Assault	721	1,021	-29.4 %	2,803	3,724	-24.7 %	17,137	21,810

NYPD CompStat

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What is IFM™ Forensic Intelligence?

IFM is a forensic intelligence tool that can drive intelligence-led policing. IFM technology will identify a firearm when it is not recovered and provide the shortest time to crime link between the purchase or acquisition of a firearm and its first use in crime.

IFM Impact On Forensic Intelligence

- *There is an obvious fact; firearm trafficking investigations are aided by rapid firearm identification.*
- *Firearms are rarely recovered at crime scenes, but fired cartridge casings are almost always recovered.*
- *Current firearm identification technologies used such as IBIS are limited to tracing firearms that are recovered at the scene.*
- *There is a need for a technology that leverages existing forensic infrastructure and adds to the mosaic of forensic intelligence*