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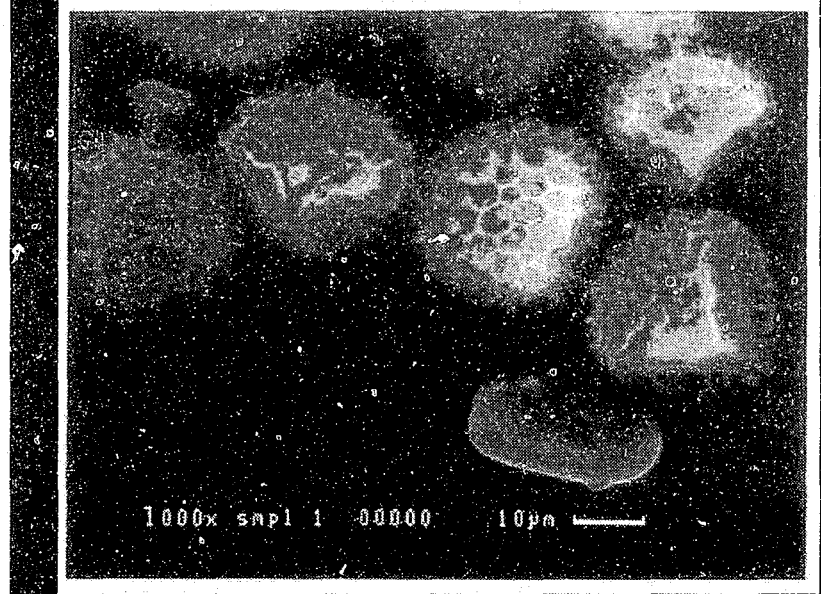

Collection and Identification Guidelines for Traces from Latex Condoms

DRUGFIRE: Forensic Firearms Identification

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DRUGFIRE:

Revolutionizing Forensic Firearms Identification and Providing the Foundation for a National Firearms Identification Network

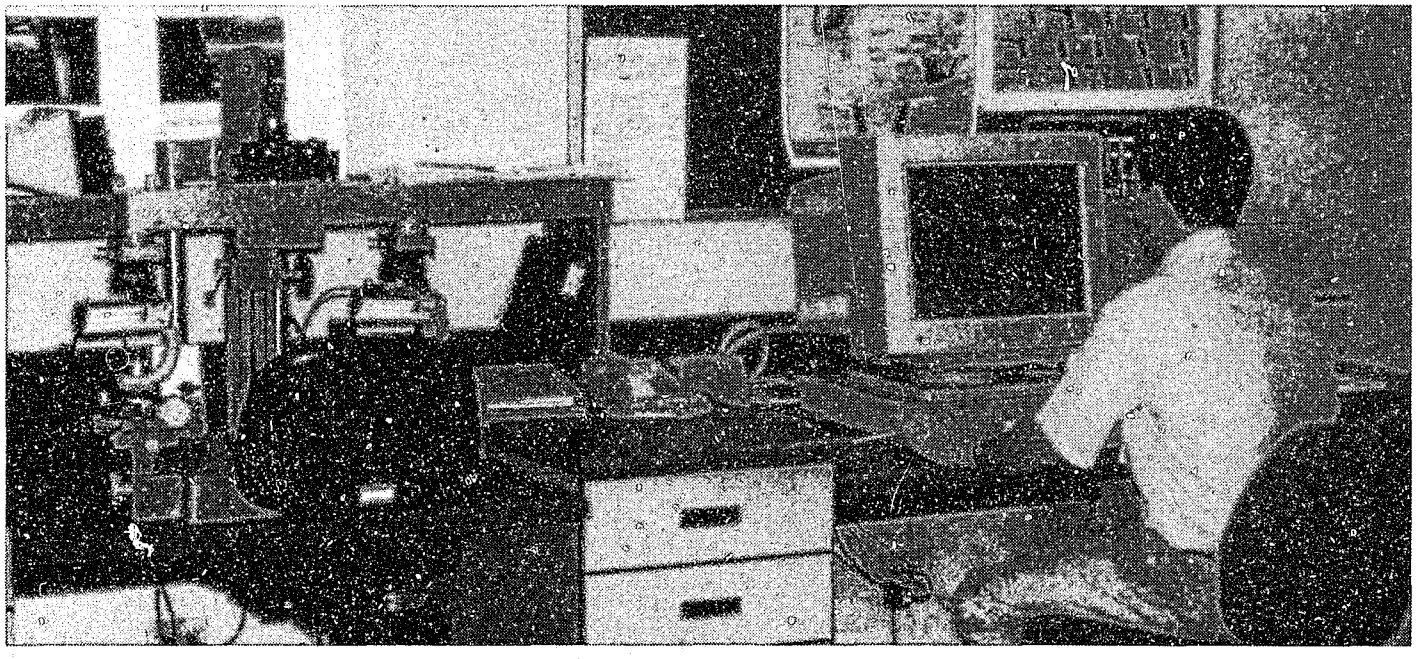
Robert W. Sibert
Federal Bureau of Investigation
Washington, DC

On June 20, 1993, Reginald Taylor and Darlene Johnson were wounded by gunshots as they were standing near a telephone booth on a Baltimore street corner. Three weeks later, another Baltimore citizen, Michael Tillman, was killed by gunshots as he sat on the steps of a house in another area of the city. Five days later, Dorian Brown was walking with his wife and a friend down a street in another section of the city when he was fatally wounded by gunshots. All of the shots that struck these four victims were fired by an unknown assailant(s).

These shootings, which seemed unrelated, were linked by the Baltimore Police Department Crime Laboratory through the use of a revolutionary new forensic tool known as DRUGFIRE. DRUGFIRE is an automated, database-driven, multimedia firearms evidence imaging system. It was developed by the FBI and initially installed in crime laboratories in the Baltimore/Washington (BAL/WDC) metropolitan areas in July 1992. Since its deployment, DRUGFIRE has been refined and improved through feedback provided by the forensic firearms examiners using the system. It is designed to significantly increase the effectiveness of forensic firearms examiners in maintaining, sharing, and searching unsolved firearms case evidence files.

As the firearms evidence from each of the previously described shootings was entered and searched in the DRUGFIRE system, the shootings were subsequently linked through the discovery that the same 9mm firearm was used in each incident. Police arrested John Artis on July 22, 1993 and recovered a 9mm Glock semiautomatic pistol from his residence. Test-fired specimens from the pistol were searched in the DRUGFIRE system and matched to the firearms evidence collected at the scene of each of the shootings. The electronic image associations made through the DRUGFIRE system were verified by traditional comparison microscopic examination of the firearms evidence.

DRUGFIRE has been used by firearms examiners to link apparently unrelated shooting incidents to each other and/or a recovered firearm in hundreds of cases. Through the use of the DRUGFIRE system, as many as nine separate shooting incidents have been linked by the discovery that cartridge cases ejected at the scenes were fired from the same firearm. DRUGFIRE has demonstrated that firearms are being retained by criminals and used repeatedly.



Automated DRUGFIRE firearms evidence imaging system.

The FBI DRUGFIRE Program

The impetus for the FBI's development of DRUGFIRE was the escalating number of violent crimes involving firearms. The DRUGFIRE program was established as part of the FBI's response to the call from the Office of National Drug Control Policy for an emergency action plan to help the Washington, DC police cope with the rising tide of drug-related violence, particularly street crimes involving handguns. The name, DRUGFIRE, reflects the FBI's focus on linking firearms evidence from violent street crimes, most of which are drug-related.

The deployment of DRUGFIRE marked the first time that regionally clustered forensic laboratories were able to centrally store, search, and share forensic firearms data and imagery. Moreover, it marked the first time that forensic laboratories were able to conduct remote, side-by-side microscopic comparisons. Previously, ammunition components could only be compared when mounted on a single comparison microscope within a single laboratory. Now, with DRUGFIRE, digital images of these items are exchanged over the telecommunications network, allowing different laboratories to compare the items remotely, thus overcoming the jurisdictional, logistical, and chain-of-custody impediments.

Firearms Evidence and Identification Techniques

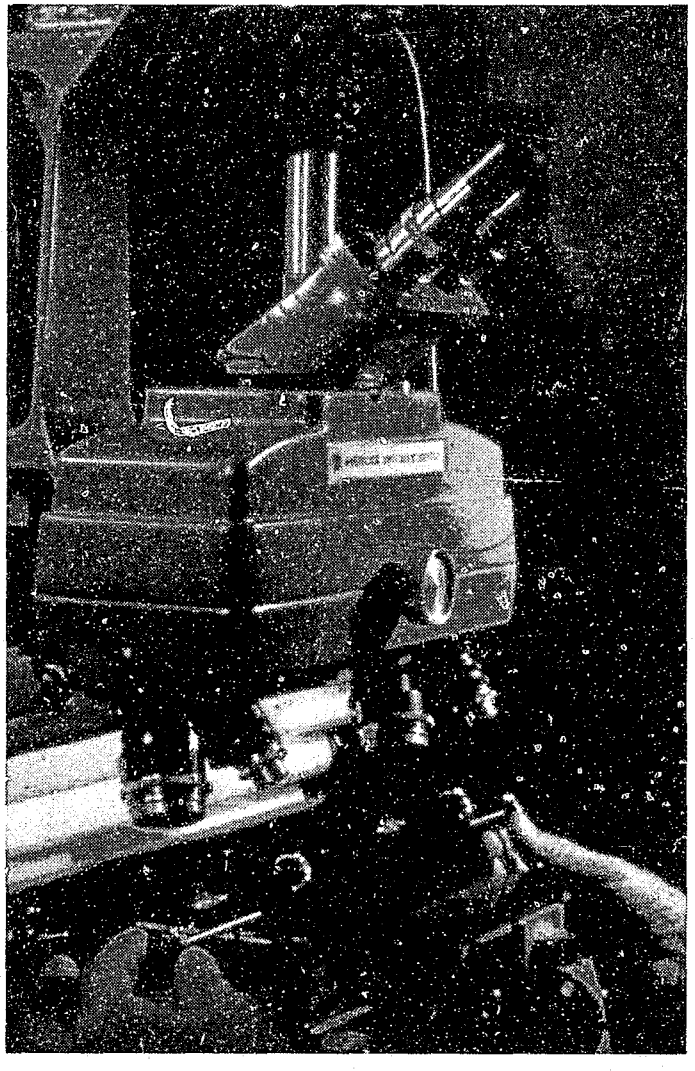
Within the last decade, the use of semiautomatic and automatic firearms has become much more prevalent in urban street crimes. When firearms of this type are used in a crime, fired cartridge cases are automatically ejected and often recovered at the crime scene. In addition, fired bullets may also be recovered at the scene or from the bodies of victims.

During firing, a firearm imparts microscopic marks to bullets and cartridge cases. These marks, the "fingerprints" of the firearm, can be microscopically compared and positively associated with the firearm that produced them. However, these marks are unlike fingerprints in that they tend to change from shot to shot, particularly in the case of the microscopic marks imparted to fired bullets. The limited reproducibility of bullet marks is further compounded by the deformation and surface mutilation which occurs upon impact. However, the microscopic marks imparted to fired cartridge cases and shotshell casings tend to be more reproducible and identifiable shot after shot.

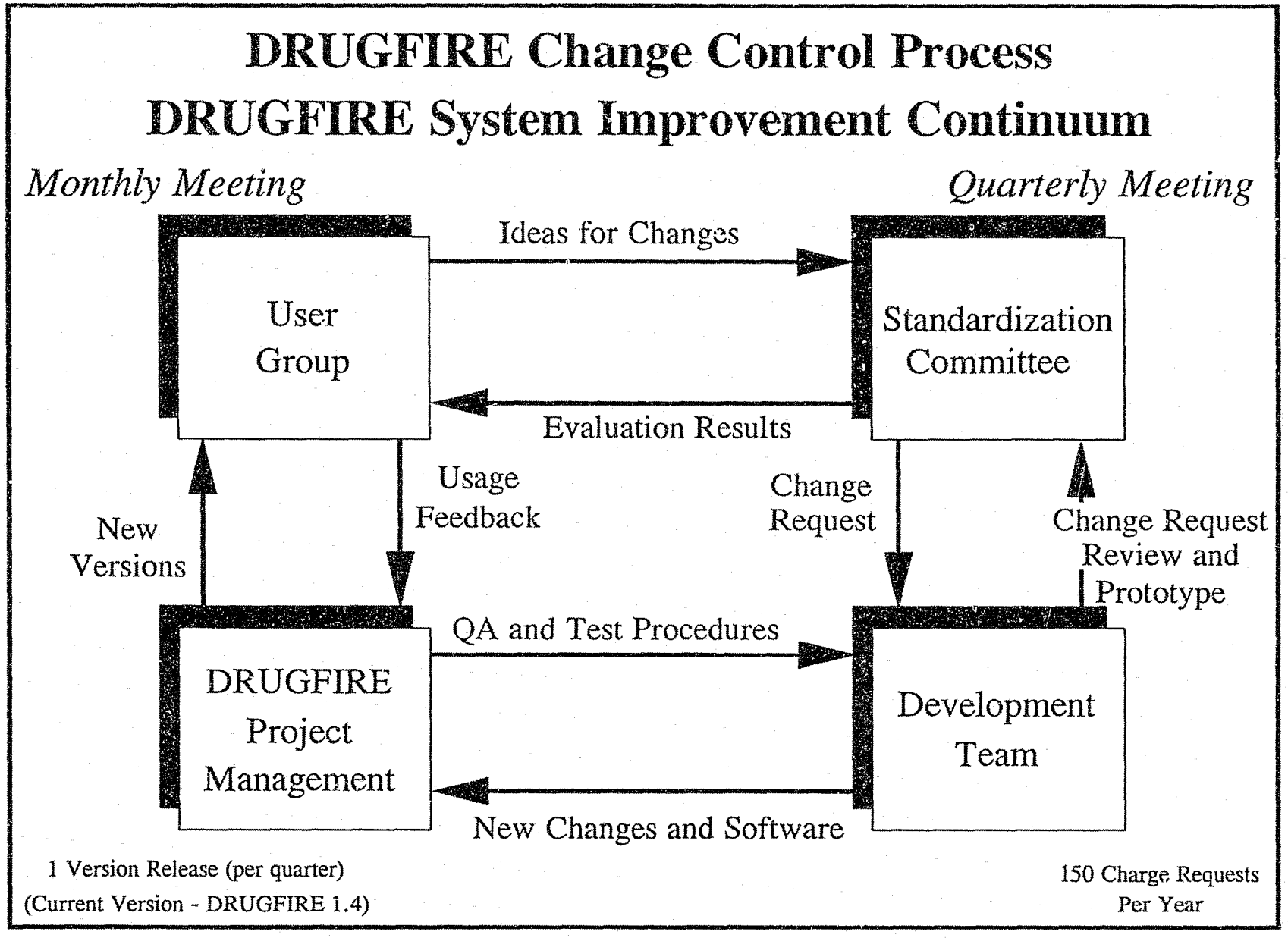
Recognizing the nature of the microscopic marks on fired bullets and cartridge cases, the DRUGFIRE system has focused on providing a means for storing, searching, and sharing bullet and cartridge case imagery. However, for the reasons cited and for cost-effectiveness, DRUGFIRE's principal emphasis has been on the comparison of cartridge case imagery, rather than bullet imagery. Nevertheless, images of highly characteristic bullet striations can be stored in the DRUGFIRE system as supplemental images and compared.

DRUGFIRE represents a major technological advancement in the discipline of forensic firearms identification. Microscopic comparisons of firearms evidence have changed little since the development of the ballistic comparison microscope over 70 years ago. Before the advent of DRUGFIRE, laboratory examiners were unable to effectively compare the immense quantities of firearms evidence from unsolved cases that were accumulated by different regional crime laboratories. Moreover, they could not effectively compare the ever-increasing quantities of firearms evidence within their own laboratories. Recent advances in desktop computing, telecommunications, and imaging have been incorporated into the DRUGFIRE system to make it an innovative, cost-effective solution.

It is important to note that DRUGFIRE does not replace the qualified forensic firearms examiner in making microscopic comparisons and identifications. It merely serves as a screening tool to extend the capabilities of the examiner. All probable associations made through the DRUGFIRE system will be verified by a qualified forensic firearms identification examiner using traditional, court-accepted comparison microscope techniques. Accordingly, no admissibility issues should arise in court as a result of the use of DRUGFIRE.



Comparison microscope.



Change Control Process Continuim has provided a means of continuing to improve the system based on user feedback.

Success of the DRUGFIRE System

The success of DRUGFIRE has exceeded initial expectations. Numerous unsolved shooting cases have been linked to each other and to firearms seized from suspects in presumably unrelated arrests. The BAL/WDC DRUGFIRE network has been operational for approximately 2 years. It links two city police department crime laboratories (Baltimore City and Washington Metropolitan), two state crime laboratories (Virginia State Police and Maryland State Police), two federal crime laboratories (Bureau of Alcohol, Tobacco and Firearms and the FBI), and one county police crime laboratory (Prince George's County, Maryland Police Department) to a central, shared firearms evidence information and image database.

In the BAL/WDC network, DRUGFIRE has been used to link over 370 cases (shooting incidents, recovered firearms, etc.). Most importantly, there have been approximately 200 cold hits (linkages of a pair of cases that were not previously known or suspected to be related). Approximately 16% of the cartridge cases recovered in shooting incidents that have been logged in the DRUGFIRE system have been linked. Many of the linked shooting incidents occurred in different jurisdictions from days to over a year apart. Both the law enforcement community and the general public have benefitted, as the DRUGFIRE system has assisted in the quick identification, prosecution, and incarceration of individuals involved in violent firearms crimes. Undoubtedly, many lives may been saved.

The development and deployment of the DRUGFIRE system has increased the solution rate of serial, gang, and drug-related shootings by providing a means for the following:

1. Collecting and sharing forensic firearms data and imagery.
2. Rapid, comprehensive searching of local and regional firearms evidence files.
3. Overcoming jurisdictional and logistical constraints by performing remote electronic comparisons of digital images.
4. Linking unsolved shootings to other shooting incidents and/or confiscated firearms.
5. Extending the capabilities and expanding the crime-solving role of forensic laboratories.
6. Utilizing firearms evidence to link repeat offenders to crimes and expediting their identification and apprehension.

Whereas forensic firearms identification examinations were previously limited to the simultaneous comparison of two specimens on a single microscope, images of specimens can now be stored in a centralized, regional database, transmitted between laboratories, and remotely compared side-by-side on split-screen monitors. Most recently, the effectiveness of DRUGFIRE has been enhanced by the addition of new automated image analysis functionality. A sophisticated algorithm called RIFEaL (Rotationally Invariant Feature Extraction Algorithm) authomatically compares and ranks the similarity of the breech face marks of fired cartridge cases.

Establishment of Additional DRUGFIRE Systems

During the past 3 years, the DRUGFIRE system has evolved from a conceptual solution for a recognized need to a successful operational system. As a result of the success of the BAL/WDC DRUGFIRE system, a replicate eight-laboratory system was deployed in southern California in October 1993. DRUGFIRE systems have recently been deployed in crime laboratories in Georgia and Chicago/northern Illinois, and additional states (Florida, New York, Ohio, Indiana, and Kansas) are in the process of obtaining DRUGFIRE systems. A number of other state and local crime laboratories have also expressed their intent to obtain DRUGFIRE in the near future.

The FBI will take responsibility for and bear the expense of continued development and testing of DRUGFIRE in cooperation with federal, state, and local crime laboratories. The DRUGFIRE software will be provided, free-of-charge, along with installation, training, user support, and future software upgrades and version releases. Each laboratory will be responsible for purchasing the computer equipment required to run the DRUGFIRE software and for providing laboratory space and qualified personnel to operate the system.

Federal, state, and local laboratories will be encouraged to work with the FBI in defining and revising the standard procedures and conventions needed to ensure that the text and image data for firearms evidence stored in DRUGFIRE are compatible and exchangeable between firearms laboratories. Thus, the forces of federal, state, and local law enforcement agencies will be combined to counter the epidemic of firearms-related street crime.

Forming a National DRUGFIRE Network

The FBI plans to work with other firearms laboratories throughout the United States to form a national computer network of forensic firearms laboratories. The FBI Laboratory does not envision DRUGFIRE becoming a national database that centrally stores forensic data and imagery for all firearms cases in the United States. Rather, DRUGFIRE will be a national network of firearms laboratories, clustered together by state or other regional groupings, which will exchange information with other DRUGFIRE clusters. Within the next year, this concept will be tested in two locations (Georgia-Florida and Illinois-Indiana-Ohio) by establishing high-speed, inter-city communication links connecting the hub sites in each state. Data communications between DRUGFIRE clusters will provide the final building block to make DRUGFIRE a national crime-fighting tool, allowing the approximately 160 firearms laboratories in the United States to exchange investigative information from firearms-related cases.

Standards and Reference Materials

As a bonus for firearms examiners, the same computer hardware that runs DRUGFIRE can be used to store an image database of firearm and ammunition exemplars from the FBI Laboratory's Reference Firearms Collection and Standard Ammunition File. This collection is the largest and most comprehensive in the world. Multiple images representing each exemplar will be stored on CD-ROM. A special database added to the DRUGFIRE software will provide access to these images. When this expanded capability is available, beginning next year,

DRUGFIRE users will have full access to the FBI's extensive reference collections to help identify firearms evidence. These comprehensive image files will provide the foundation for a clearinghouse operation that will support the addition of other firearm and ammunition exemplars.

The Future of DRUGFIRE

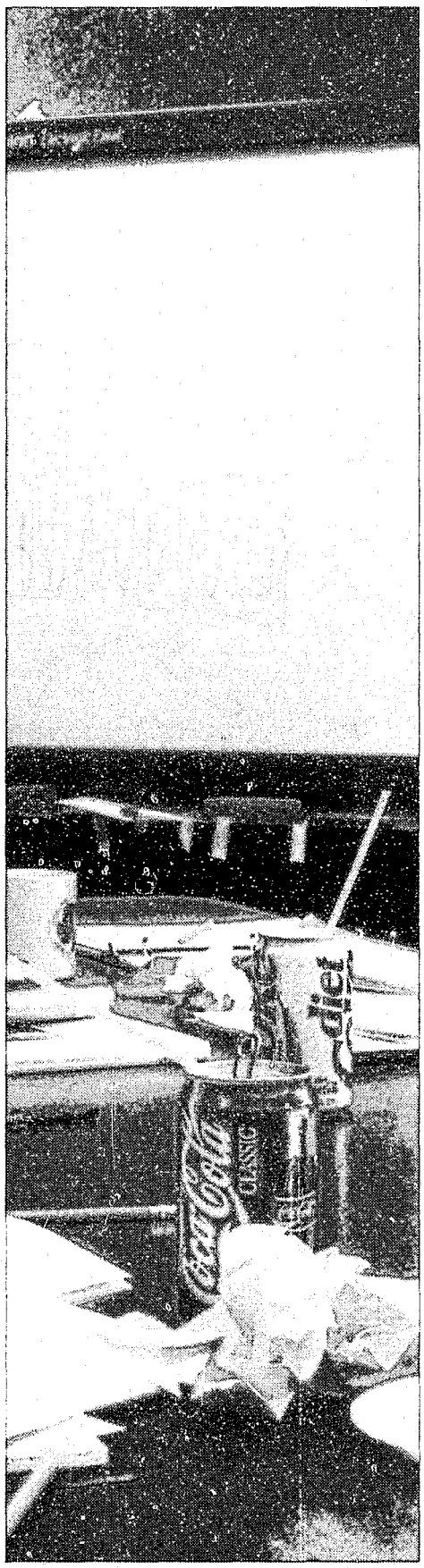
DRUGFIRE is well-suited to the FBI's mission of working in partnership with federal, state, and local law enforcement agencies to fight violent crime through the use of modern technology. The FBI is fully committed to the continued development and deployment of the DRUGFIRE system. DRUGFIRE is an expansion of the FBI Laboratory's long-standing role of providing operational support, training, standards, and reference materials to the forensic firearms identification community.

The continued objective of the DRUGFIRE program will be the provision of a cost-effective, scalable technology which integrates well into normal laboratory work flow. DRUGFIRE exemplifies how the FBI Laboratory, as a national, full-service crime laboratory, is in a unique position to develop new technology that can be put to immediate use by all crime laboratories to help fight firearms-related violence. As a major FBI initiative, the DRUGFIRE program seeks to foster a true partnership with other federal, state, and local law enforcement agencies. The FBI is anxious to implement this proven, low-cost enterprise so that American citizens can benefit directly from the expanded forensic capabilities provided by advanced technology.

DRUGFIRE Program Concepts

The concepts underlying the development and deployment of the DRUGFIRE system have been simple:

1. Use the experience and resources of the FBI as the foundation for working with federal, state, and local crime laboratories to develop and operate a computer database system which links serial shootings and identifies suspects when firearms evidence is recovered.
2. Design the system to automatically compare firearms evidence received in a single crime laboratory, while allowing any laboratory to rapidly compare and exchange forensic data and imagery with other crime laboratories.
3. Design the system to run on a low-cost computer that individual laboratories can afford to purchase, and provide, free-of-charge, the software, training, and technical support needed for forensic firearms laboratories to operate independently of the FBI.
4. Listen to user feedback to understand how DRUGFIRE is working and how it can be improved to better support federal, state, and local law enforcement agencies.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